TECHNICAL MANUAL

TECHNICAL MANUAL

PILOT A2, CE2
RS232 Events log

From serial n° 17730124 till ...

A company of
Fresenius Kabi

Fresenius Vial
Infusion Technology

Revision table

TM Pilot A2 CE2 RS 232 Events Log_en : ref NT 1734

Date	Revision	Chapter	Description
03/04/03	0	All index "a"	Creation
08/01/07	1	index "b"	New EMC standard, spare parts up date

1 Overview 7
1.1 General 7
1.2 Overview diagram 8
1.3 Precautions to be taken before use 9
1.4 Internal safety features 9
1.5 Technical characteristics 9
1.5.1 Electrical specifications 9
1.5.2 Electronic specifications 9
1.5.3 Mechanical specifications 9
1.5.4 Conformity and norms 10

2 Description and operation 11
2.1 Physical description 11
2.1.1 The display board and the front panel 12
2.1.2 CPU board 14
2.1.3 The power supply board and the battery 17
2.1.4 Mechanical gear box unit 20
2.1.5 Mechanical plunger unit 20
2.2 Functional description 21
2.2.1 Syringe control and maintenance assembly 21
2.2.2 Motorisation assembly 21
2.2.3 External connection sub-assembly 21

3 Description of the menus 23
3.1 Configuration menu of the current operation parameters 23
3.1.1 Menu access 24
3.1.2 PAr 1, configuration of the memorisation type 25
3.1.3 PAr 2, configuration of the syringe selection type 25
3.1.4 PAr 3, configuration of the maximum flow rate that may be selected on the keyboard 26
3.1.5 PAr 4, configuration of the list of syringes that may be selected 26
3.1.6 PAr 5, configuration of the compulsory priming 27
3.1.7 PAr 7, configuration of the KVO flow rate 27
3.1.8 PAr 9, configuration of the RS232 communication speed 28
3.1.9 PArA, configuration of the empty syringe mode 28
3.1.10 PArb, configuration of the frequency of preventive checks 29
3.1.11 PArC, configuration of the drug display mode 29
3.1.12 PArd, configuration of the Flanges detection mode 30
3.1.13 PArF, configuration of the bolus flow memorisation mode 30
3.1.14 PArG, configuration of the drugs list 31
3.1.15 PArJ, configuration of the mains disconnection signal 32
3.1.16 PAr0, configuration of the date and time 32
3.1.17 Typical syringe/details correspondence table 33

3.2 Calibration menu 35
3.3 Service test menu 37

4 Preventive maintenance 39
4.1 Recommendations 39
4.2 Maintenance schedule 39
4.2.1 Preventive maintenance 39
4.2.2 Quality control 39
4.3 Checks 41
4.3.1 Test access 41
4.3.2 Visual check 41
4.3.3 Running time and last servicing inspection date 42
4.3.4 Indicator lights check 42
4.3.5 Keyboard check 43
4.3.6 Checking the battery voltage 44
4.3.7 Display of the last 10 alarms 44
4.3.8 Total operation time check 46
4.3.9 TTL serial link test 46
4.3.10 RS 232 serial link check 47
4.3.11 Checking the software version. 47
4.3.12 Checking the ADC 48
4.3.13 Checking the position sensor 48
4.3.14 Buzzer test 49
4.3.15 Display of the calibration values 49
4.3.16 Checking the syringe clamp 49
4.3.17 Checking the syringe group number 50
4.3.18 Checking the list of syringes 50
4.3.19 Checking the disengagement 50
4.3.20 Checking the flanges detection system 50
4.3.21 Checking the syringe head detection system 51
4.3.22 Checking backpressure 52
4.3.23 Checking the pre-alarm and end of infusion alarm 52
4.3.24 Checking the linearity 53
4.3.25 Checking mains/battery operation 53
4.3.26 Battery autonomy test 54
4.3.27 Continuity test 54
4.3.28 Quality Control Certificate 55
4.4 Flow rate control 57
4.4.1 Measurement with a computer 57
4.4.2 Measurement with scales 59
4.4.3 Measurement using a test tube 61
4.5 Cleaning and disinfecting 63
4.6 Storage 64

5 Diagnostic 65
5.1 Troubleshooting guide 65
5.2 Error messages 67

6 Operation sheets 71
N°1, Procedure: Display and central unit boards 73
N°2, Procedure: Syringe clamp 75
N°3, Procedure: Syringe detection system 77
N°4, Procedure: Motor + Opto + Disk 83
N°5, Procedure: Dynamometer sensor 85
N°6, Procedure: Plunger advance control potentiometer 91
N°7, Procedure:
Plunger cover and/or disengagement lever + anti-siphon arm 93
N°8, Procedure: Power supply board 95
N°9, Procedure: Battery door and battery 97
N°10, Procedure: Plug holder wired 99
N°11, Procedure: Ribbon cable winding kit 101
N°12, Procedure: Syringe head detection plunger kit 105
N°13, Procedure: Centering ring kit 109
N°14, Procedure: Flex circuit and tube kit 113
N°15, Procedure: Upper and lower cases 119

7 Calibration 123
7.1 Calibration procedure 123
7.1.1 Calibration access 123
7.1.2 CtA.4 Calibration of the 3 battery voltage levels. 124
7.1.3 CtA.6 Calibration of the position sensor. 124

8 Spare parts catalogue 125
8.1 Upper case 125
8.2 Lower case 127
8.3 Plunger unit 129
8.4 Mechanical Gear box 133
8.5 Labels 135

1 Overview

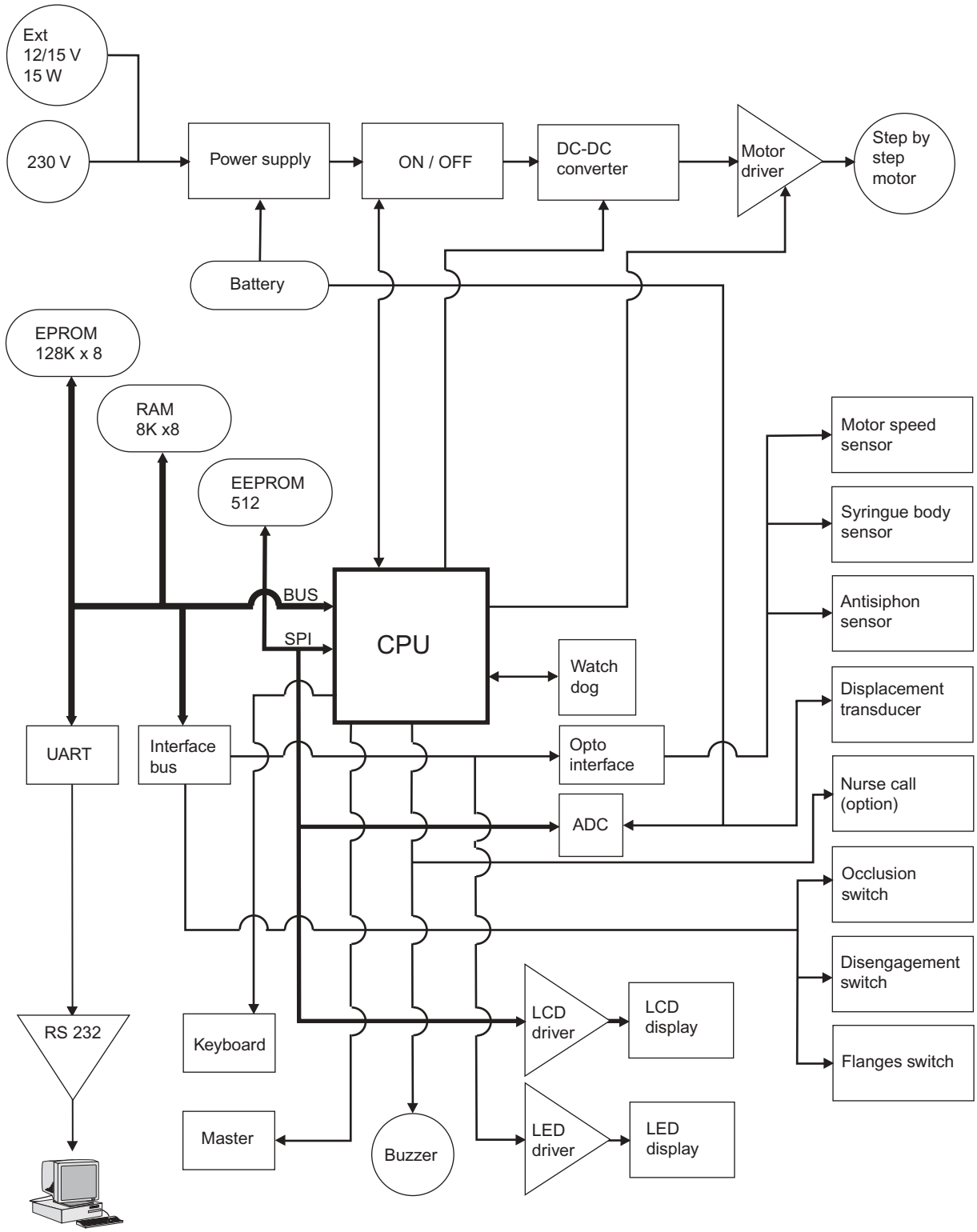
1.1 General

The **Pilot A2 RS 232 Events log** is a syringe pump intended for the infusion of intravenous agents at a accurate, low flow rate. The wide choice of syringes, the use of the universally recognised control symbols and the synoptic display of the alarms contribute to making the **Pilot A2 RS 232 Events log** easy to use. The adjustable occlusion detection, the correct positioning detection and the overall syringe protection system guarantee optimum safety.

Its technical characteristics, the flow range from 0.1 to 400 ml/hr (configured at 200 ml/hr) and its excellent accuracy (±1% on the device) contribute to making the **Pilot A2 RS 232 Events log**, the ideal instrument for medical services.

The **Pilot A2 RS 232 Events log** is equipped with a 16ko-EEPROM enabling the memorization of 896 events. These events are available for consultation through the ISCTRL maintenance software, 4.1 and upper version.

1.2 Overview diagram



1.3 Precautions to be taken before use

The symbol ⚠ in the concise instrument instructions guide of the device recommends that the operator's guide should be read complelety in accordance with standard EN 60601-1.

Fresenius Vial may in no case be held responsible for medical problems or any other problems resulting from inadequate use of the equipment.

Refer to the User's instructions for further details.

1.4 Internal safety features

As soon as it is switched ON, the device activates a continuous function inspection system. Any internal failure or any problem related to the operating procedure in progress is detected immediately. Nevertheless, abnormal operation of the equipment with no obvious cause must always be reported to the qualified technicians in your establishment or our After Sales service.

In case of single fault condition, an alarm is activated for any flow rate deviation of ± 5% in comparison with the normal flow rate.

A second check activates an alarm in the event of deviation of 1 ml in comparison with the anticipated infused volume, or if a flow rate deviation of ± 20% is identified. The alarm is triggered by the most rapidly detected deviation.

The **Pilot A2 Events log** is fitted with an internal battery to continue operation in the event of a power cut. Furthermore, a safety fuse protects the mains from further disturbance.

1.5 Technical characteristics

1.5.1 Electrical specifications

- Power supply: 230 V - 50-60 Hz.
- Max. consumption : 23 VAC.
- Fuse F2: 100 mAT 250 V IEC 127.
- Battery: 6 V - 1,1 / 1,3 Ah.
- External power supply: 12 - 15 V DC -15 W.

1.5.2 Electronic specifications

The **Pilot** syringe pump is fitted with 3 circuit boards:

- Motor power supply and control board.
- CPU board.
- Keyboard display board.

1.5.3 Mechanical specifications

- Overall dimensions H x W x D: 120 x 330 x 155 mm.
- Weight: approximately 2,2 kg.

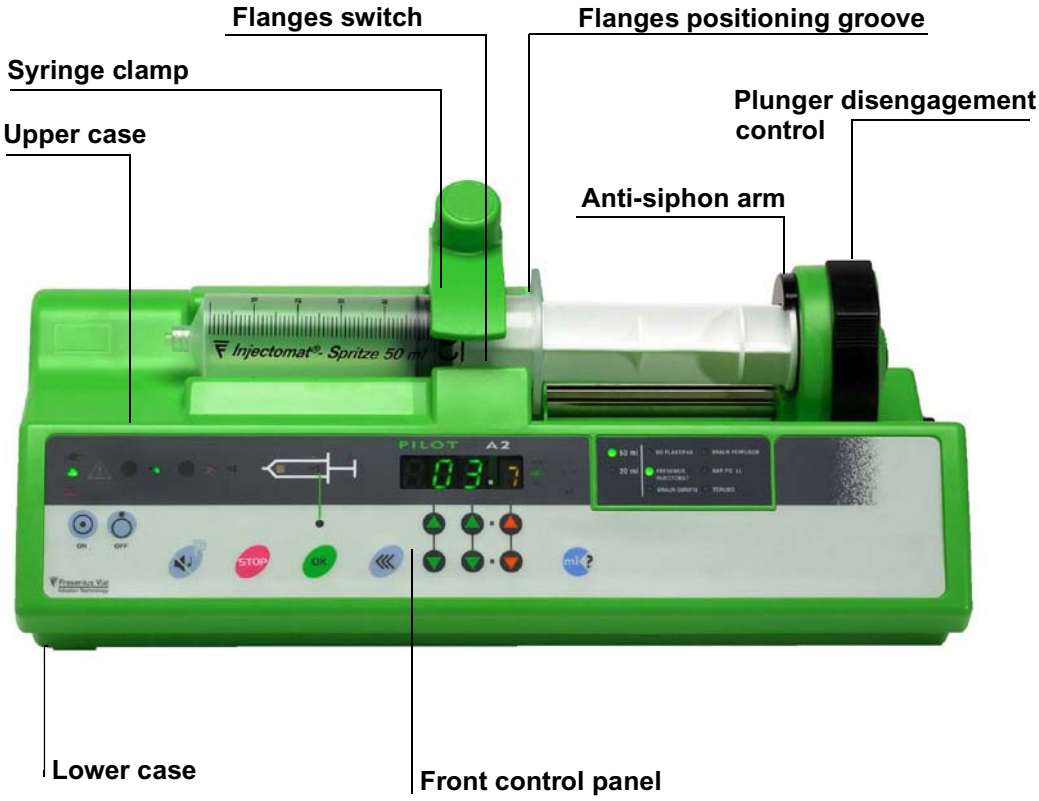
1.5.4 Conformity and norms

CE 0459	Conform to the 93/42/CE Medical Directive.	**IP34** Protection against splashing liquid.
Safety of Electro Medical Equipements	Conform to EN/IEC 60601-1 and EN/IEC 60601-2-24	Protection against leakage current: CF type.
EMC (ElectroMagnetic Compatibility)	Conform to EN/IEC 60601-1-2 (first edition) and EN/IEC 60601-2-24	Protection against electric shocks: class II.

Since 2001,electromagnetic compatibility standards have evolued.
***Pilot A2 RS 232 Events log** that serial number is higher than 18908961 with EN/IEC 60601-1-2 (second édition) and EN/IEC 60601-2-24 complies standards.*
Detailed information concerning electromagnetic compatibility is available in the chapter "Guidance and manufactureris declaration on EMC" of the User Manual.

2 Description and operation

2.1 Physical description



The **Pilot A2 Events log** is fitted with an upper case and a lower case.

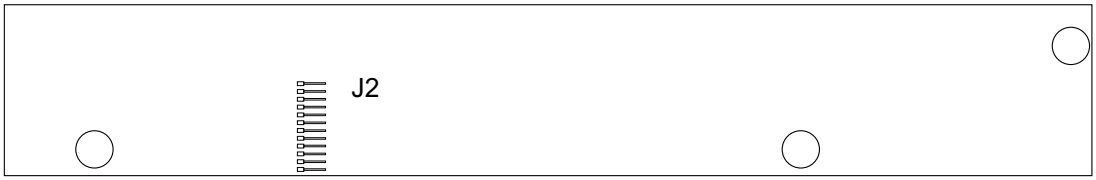
- The upper case holds the syringe clamp and contains:
  - A display board associated with the front control panel.
  - A CPU board.
- The lower case contains:
  - A power supply board and a battery.
  - A mechanical base unit.
  - A plunger unit.

2.1.1 The display board and the front panel

The display board is mounted under the front control panel and is fitted with all the organs required for man-machine interaction.

- Keyboard interface.
- Control lamps and overview diagrams.
- 7-segment display units.

Solder side display board.



Component side display board.

This board is connected to the different parts of equipment by means of connectors.

J1 connector to CPU board

Pin	Description	
1	SEG1 display matrix	Line 1
2	SEG2 display matrix	Line 2
3	SEG3 display matrix	Line 3
4	SEG4 display matrix	Line 4
5	SEG5 display matrix	Line 5
6	SEG6 display matrix	Line 6
7	SEG7 display matrix	Line 7
8	SEG8 display matrix	Line 8
9	COL1 display matrix	Column 1
10	COL2 display matrix	Column 2
11	COL3 display matrix	Column 3
12	FAIL LED control	Fail
13	COL/DIG 9 LED type control	"
14	LIG1 keyboard interface	Line 1
15	LIG2 keyboard interface	Line 2
16	LIG3 keyboard interface	Line 3
17	LDSECT lighting control	Mains LED
18	+5V power supply	
19	VBAT power supply	
20	GND power supply	

J2 connector to keyboard

Pin	Description
1	Column 1
2	Column 2
3	Column 3
4	Column 4
5	Column 5
6	Column 6
7	Line 1
8	Line 2
9	Line 3
10	Ton
11	Toff
12	Gnd power supply

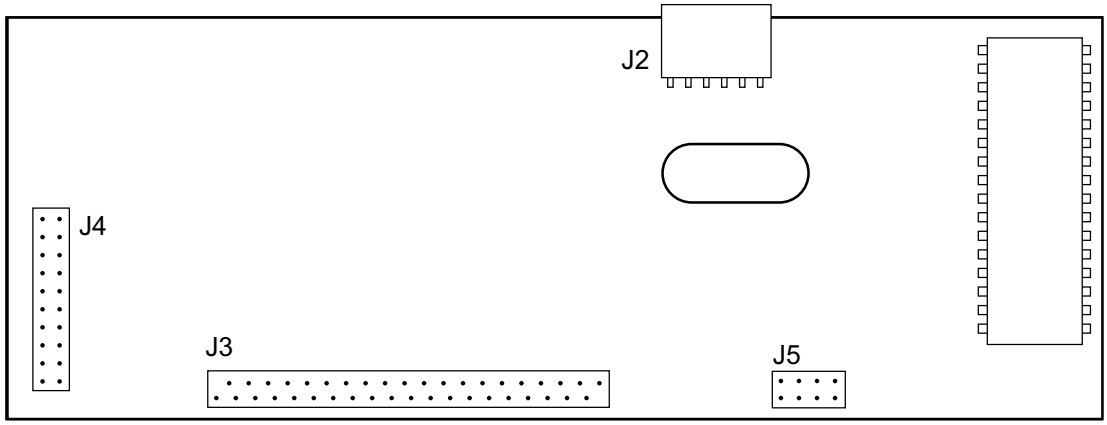
J3 connector to CPU board

Pin	Description
1	Ton ON key
2	Toff OFF key
3	SI SPI bus
4	Clk SPI bus
5	CSLCD SPI bus
6	Buzz BUZZER control
7	Vbat power supply
8	Gnd power supply

2.1.2 CPU board

The CPU board holds an 80C32 microprocessor. It is mounted and connected to the display board through J4 and J5 connectors.

A ribbon cable connects this to a power supply board by means of a connector J3.



CPU board

J2 connector: to flanges detection switch and syringe detection opto-electronic sensor

Pin	Description
1	Ground
2	Flanges contact
3	Opto anode diode +5V
4	Common points between cathode LED , opto 1 and opto 2 transistor emitters.
5	Opto 1 transistor collector
6	Opto 2 transistor collector

J3 connector to power supply board

Pin	Description	
1	+5V	
2	Gnd	
3	+Vbat	
4	Gnd	
5	Phase A	Motor control
6	Phase B	Motor control
7	Phase C	Motor control
8	Phase D	Motor control
9	I signal	Motor control
10	Boost signal	Motor control
11	Sopt1	Opto rotation motor output
12	Sopt2	Opto anti-siphon
13	Apinf	Nurse call independent of the buzzer signal
14	Cdopt1	Opto rotation motor control output
15	Cdopt2	Opto anti-siphon module control
16	Off	Signal off key pressed
17	Sect	Mains power supply on signal
18	Cdalim	Power cut signal

J3 connector to power supply board

Pin	Description	
19	Ldsect	Mains LED control
20	Cts	Clear to send
21	Deb/off	Disengagement signal
22	Rts request to send	Request to send
23	Occ/off	Occlusion signal
24	Buz	Nurse call relay control
25	Eoc	End Of adc conversion
26	Csadc	Selection spi adc bus
27	Clk	Clock spi adc bus
28	Si	Data in spi adc bus
29	So	Data out spi adc bus
30	Cdana	Analogue sensor power supply control
31	Rx2	Receive data TTL
32	Tx2	Transmit data TTL
33	Txd1	Transmit data TTL
34	Rxd1	Receive data TTL
35	Ton	ON key
36	Toff	OFF key
37	+Vbat	Power supply
38	Gnd	
39	+5V	
40	Gnd	

J4 connector to display board

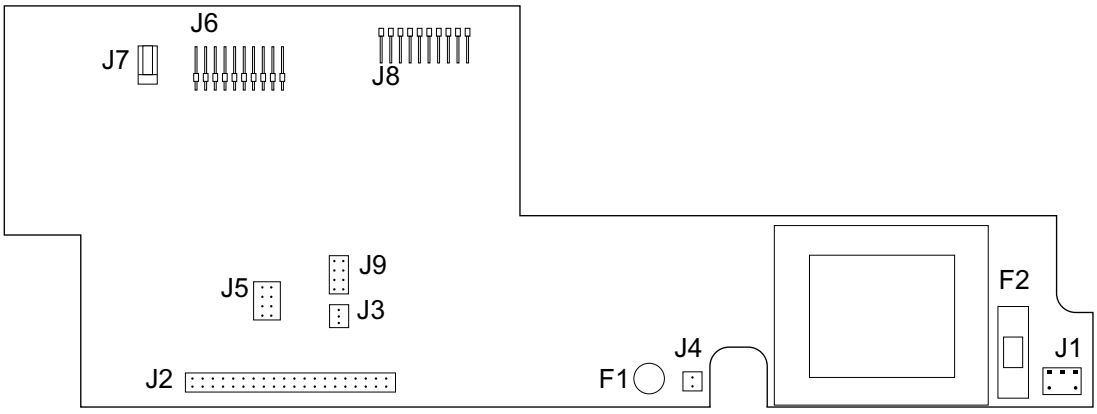
Pin	Description	
1	Seg1 display matrix	Line 1
2	Seg2 display matrix	Line 2
3	Seg3 display matrix	Line 3
4	Seg4 display matrix	Line 4
5	Seg5 display matrix	Line 5
6	Seg6 display matrix	Line 6
7	Seg7 display matrix	Line 7
8	Seg8 display matrix	Line 8
9	Col1 display matrix and keyboard	Column 1
10	Col2 display matrix and keyboard	Column 2
11	Col3 display matrix and keyboard	Column 3
12	Fail diode fail control	
13	Rdcrt current reduction control	
14	Lig1 keyboard interface	Line 1
15	Lig2 keyboard interface	Line 2
16	Lig3 keyboard interface	Line 3
17	Ldsect mains LED control	
18	+5V power supply	
19	Vbat power supply	
20	Gnd power supply	

J5 connector to display board

Pin	Description
1	Ton ON key
2	Toff OFF key
3	Si spi bus
4	Clk spi bus
5	Cslcd spi bus
6	Buzz buzzer control
7	Vbat power supply
8	Gnd power supply

2.1.3 The power supply board and the battery

The power supply board is mounted on the lower case. It allows to supply the electronic parts using the network 230 V AC or the external 12 / 15 DC. It also charges the 1.1 or 1.3 Ah battery.



Power supply board.

This board is connected to the different parts of equipment by means of connectors.

J1 connector to mains

Pin	Description
1	Neutral
2	Phase

J2 connector to CPU board

Pin	Description	
1	+5V controlled power supply	
2	Gnd power supply	
3	+Vbat power supply	
4	Gnd power supply	
5	Phase A	Motor control
6	Phase B	Motor control
7	Phase C	Motor control
8	Phase D	Motor control
9	I signal	Motor control
10	BOOST signal	
11	Sopt1	Opto rotation module output
12	Sopt2	Opto anti-siphon module output
13	N.U	
14	Cdopt1	Opto rotation module control
15	Cdopt2	Opto anti-siphon module control
16	Off	Off key pressed on the ON/OFF button
17	SECT	Mains supply presence signal
18	CDALIM	Power cut signal
19	LDSECT	Mains LED control
20	CTS	Clear to send
21	DEB/OFF	Disengagement signal active at 0

J2 connector to CPU board

Pin	Description	
22	RTS	Request to send
23	OCC/OFF	Occlusion signal active at 0
24	BUZ	Nurse call relay control
25	EOC	End of ADC conversion
26	CSADC	Selection bus SPI ADC
27	CLK	Clock bus SPI ADC
28	SI	Data IN bus SPI ADC
29	SO	Data out bus SPI ADC
30	CDANA	Analogue sensor power supply control
31	RX2 receive data TTL	
32	TX2 transmit data TTL	
33	TXD1 transmit data TTL	
34	RXD1 receive data TTL	
35	Toff	OFF key
36	Ton	ON key
37	+Vbat	Power supply
38	Gnd	
39	+5V	
40	Gnd	

J3 connector to potentiometer

Pin	Description
1	Vref
2	Centre point
3	Gnd

J4 connector to internal battery

Pin	Description
1	+ battery
2	- battery

J5 connector to motor

Pin	Description
1	+Vbay
2	+Vbat
3	Phase D
4	Phase C
5	Phase B
6	Phase A
7	Opto rotation anode diode /+5V
8	Opto rotation cathode diode
9	Opto rotation transistor collector
10	GND/ opto rotation transistor emitter

J6 connector to RS232 and Master plugs

Pin	Description	
1	TX1	
2	+5V	
3	RX1	
4	Gnd	
5	Interface validation	
6	Nurse call relay common point	
7	Nurse call relay normally open	
8	Nurse call relay normally closed	
9	CD ON external on	
10	CD OFF external off	
11	I-OPTON	Motor control output
12	I-SECT	Mains led
13	+Vbat	External power supply plug
14	RX2	
15	TX2	
16	Gnd	
17	CTS	
18	RTS	
19	BUZ	
20	NC	

J7 connector to external DC power supply

Pin	Description
1	± external power supply
2	± external power supply

J8 connector to disengagement micro-switch, force sensor and anti-siphon switch

Pin	Description
1	Not used
2	Micro-switch input/output
3	Micro-switch input/output
4	Not used
5	Opto anti-siphon cathode diode
6	Opto anti-siphon anode diode/+5V
7	Opto anti-siphon transistor collector
8	Disengagement micro-switch on
9	Disengagement micro-switch off
10	Gnd

Do not forget to dismount the ribbon cable holder on the power supply board before extracting the mechanical assembly from the housing (risk of breaking the ribbon cable).

J9 connector, test points

Pin	Description
1	GND
2	Position sensor output
3	Battery discharge control output
4	Amplified force sensor output
5	Cd coupler power supply 0-5V
6	Motor control opto output
7	Force and position sensor reference voltage
8	Piston head detection opto output
9	Control/APIN F
10	Control/APIN F

2.1.4 Mechanical gear box unit

The mechanical base unit is composed of a motor-reducer block driving a screw-and-nut unit. At the shaft end, the motor receives a control panel associated with an opto-electronic switch.

The mechanical base unit also accommodates a potentiometer fitted with a rack pinion system.

2.1.5 Mechanical plunger unit

The mechanical plunger unit is mounted onto the mechanical gear box. The gear box ensures the displacement movement of the plunger through a screw / nut system.

The plunger is fitted with a disengagement control allowing to separate this from the screw-and-nut system.

2.2 Functional description

From a functional point of view, the **Pilot A2 Events Log** is composed of three sub-assemblies:

- A syringe position control and maintenance assembly.
- A motorisation assembly.
- An external connection assembly.

2.2.1 Syringe control and maintenance assembly

The syringe if fitted into the upper case and held in position by means of a syringe clamp.

Detection of the syringe size (60 cc or 20 cc) is carried out by two opto-electronic sensors mounted onto the syringe clamp.

The flanges switch ensures the syringe flanges are correctly positioned in the groove.

Associated with an opto-electronic sensor, the anti-siphon arm controls the piston position.

Composed of a micro-switch fitted to the plunger, an anti-occlusion system triggers an alarm whenever force on the piston is excessive.

2.2.2 Motorisation assembly

This sub-assembly moves the piston in the syringe.

It is put into motion by means of a motor-reducer unit associated with a screw-and-nut system.

A motor rotation disk mounted on the shaft end of the motor and associated with an opto-electronic sensor controls the rotation.

A potentiometer controls the plunger movement by means of a rack pinion system.

A micro-switch allows for control of the disengagement device.

2.2.3 External connection sub-assembly

The **Pilot A2 Events log** has three connectors located at the rear end of the lower case:

- A 12-15 V DC, 15 W type external power supply connector.
- An RS 232 connector.

3 Description of the menus

3.1 Configuration menu of the current operation parameters

The configuration menu enables users to adapt the **Pilot** to the specific needs of each department. It provides access to the menus allowing for customisation of the parameters associated with current operation modes.

Fresenius Vial recommends users to implement the selected configuration procedures in the presence of a member of its qualified personnel or a member of the technical department.

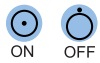
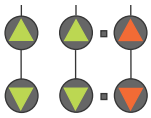
It is possible to exit the configuration mode at any time by pressing the OFF *key.*

This menu enables users to:

- PAr 1: select the type of flow rate memorisation.
- PAr 2: select the syringe selection mode.
- PAr 3: modify the maximum flow rates which can be selected using the keyboard.
- PAr 4: configure the list of syringes that can be selected.
- PAr 5: select the compulsory priming.
- PAr 7: select the KVO flow rate.
- PAr 9: select the RS232 communication speed.
- PAr A: select the empty syringe mode.
- PAr b: select the frequency of preventive checks.
- PAr C: select the drug display mode.
- PAr d: choose whether or not to activate the flanges detection mode.
- PAr F: select the Bolus memorisation mode.
- PAr G: enter the list of drugs.
- PAr J: choose whether or not to activate the mains disconnection signal.
- PAr 0: enter the current date and time.

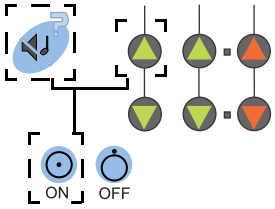
3.1.1 Menu access

Useful keys

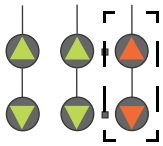
Key	Function
	**ON**, is used to switch the machine ON. **OFF**, is used to switch the machine off when pressed for over three seconds.
	SILENCE ALARM, is used to access the configuration mode of the current operation parameters.
	The selection keys allow to scroll the figures and letters on the tenths, units, tens segments etc.
	CONFIRM, is used to validate a choice.
	STOP, is used to cancel the current configuration.

Switch to configuration mode.

- Press "SILENCE ALARM" and "TENS" simultaneously.
- Maintain this position while pressing "ON".



- When PAr is shown on the display unit, release the selection of "SILENCE ALARM" and "TENS" then validate within three seconds by pressing "CONFIRM".
- PAr 1 is shown by default.
- Switching from PAr 1 to PAr 0 is carried out using the "tenths" keys.

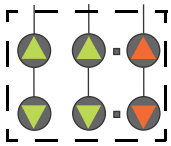


3.1.2 PAr 1, configuration of the memorisation type

This configuration enables users to choose whether or not to memorise the infusion flow rate when the **Pilot** is shut down.

■ PAr 1, press "CONFIRM"

- □ If MEM, the flow rate is memorised when the **Pilot** is shut down, this value will be displayed by default when the machine is next switched on.
- □ If noME, the flow rate is not memorised, the default value is 00.0 each time the machine is switched on.
  - ♦ Select the memorisation type using the selection keys.



- □ By validating once again, the type is memorised and it is possible to select another configuration .

The modification may be cancelled by pressing the "STOP" key.

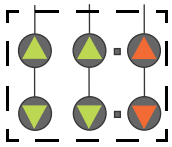
It is possible to exit the configuration mode at any time by pressing the "OFF" key.

3.1.3 PAr 2, configuration of the syringe selection type

This configuration enables users to choose the type of syringe selection.

■ PAr 2, press "CONFIRM"

- □ If SEL 3, automatic validation of the only syringe that may be selected.
- □ If SEL 4, when the **Pilot** is switched on, the user should select the type of syringe installed.
  - ♦ Choose the selection type using the selection keys.



- □ By validating once again, the type is memorised and it is possible to select another configuration .

*When mode SEL 3 is selected, and if there is a choice of more than one syringe, the **Pilot** automatically moves onto the configuration of the list of syringes that may be selected PAr 4 when the machine is next switched on.*

The modification may be cancelled by pressing the "STOP" key.

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

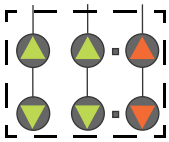
3.1.4 PAr 3, configuration of the maximum flow rate that may be selected on the keyboard

This configuration enables users to choose the maximum flow rate that may be selected using the keyboard for each type of syringe.

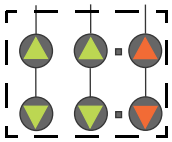
Syringe type	Min. flow rate (ml/hr)	Max. flow rate (ml/hr)
50/60 cc	0,1	400
20 cc	0,1	275

■ PAr 3, press "CONFIRM"

□ Select the syringe type using the keys.
- 20c, 20 ml.
- 50c, 50 ml.



□ Press "CONFIRM"
- Select the maximum flow rate using the keys.



□ By validating once again, the maximum flow rate is memorised and it is possible to select another configuration .

The modification may be cancelled by pressing the "STOP" key.

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

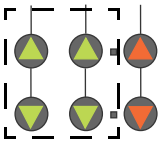
3.1.5 PAr 4, configuration of the list of syringes that may be selected

This configuration enables users to choose whether or not it may be selected for each type of active syringe.

■ PAr 4, press "CONFIRM"

□ The LED of the syringe to be configured flashes.
- If SEL, this type of syringe may be selected when the **Pilot** is switched on.
- If noSE, this type of syringe may not be selected when the **Pilot** is switched on.

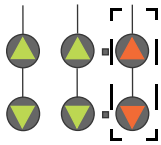
□ Make your choice using the keys.



■ Press "CONFIRM" to memorise the modification.

□ The LED of the configured syringe is:
- Lit up is it may be selected.
- Off if it may not be selected.

Details of the syringe are displayed when the "tenths" keys are pressed (see chapter 3.1.17 "Typical syringe/details correspondence table").



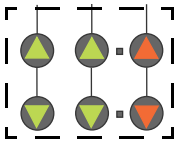
The modification may be cancelled by pressing the "STOP" key.

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

3.1.6 PArS, configuration of the compulsory priming

This configuration enables users to choose whether or not priming is compulsory after selection of a syringe.

- PArS is displayed.
  - Press "CONFIRM"
    - If PurG, compulsory priming, pressing "BOLUS" during start-up is compulsory to switch to selection of the flow rate.
    - If noPu, priming is not compulsory, the flow rate may be selected upon start-up straight after validation of the syringe.
  - Make your choice using the keys.
  - By validating once again, *the configuration* is memorised and it is possible to select another configuration .



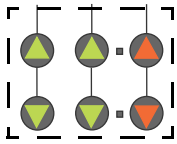
The modification may be cancelled by pressing the "STOP" key.

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

3.1.7 PAr 7, configuration of the KVO flow rate

This configuration enables users to choose whether or not to activate the switching to KVO flow rate.

- PAr 7, press "CONFIRM"
  - If tU0, KVO flow activated, the infusion continues at 1,0 ml/hr (or at the same flow rate if this is under 1,0 ml/hr) when the volume infused reaches the limit volume.
  - If not U, no KVO flow, infusion stops with a limit volume alarm when the infused volume reaches the limit volume.
  - Make your choice using the keys.



- By validating once again, the configuration is memorised and it is possible to select another configuration .

The modification may be cancelled by pressing the "STOP" key.

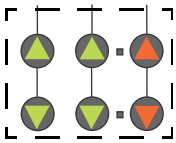
It is possible to exit the configuration mode at any time by pressing the "OFF" key.

3.1.8 PAr9, configuration of the RS232 communication speed

This configuration enables the user to select the communication speed of the RS232 link.

- PAr9, press "CONFIRM"

  - If 19200, speed at 19200 Bauds.
  - If 19200, speed at 9600 Bauds.
  - If 4800, speed at 4800 Bauds.
  - Make your choice using the keys.



  - By validating once again, the configuration is memorised and it is possible to select another configuration .

The modification may be cancelled by pressing the "STOP" key.

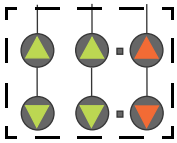
It is possible to exit the configuration mode at any time by pressing the "OFF" key.

3.1.9 PArA, configuration of the empty syringe mode

This configuration enables users to choose whether or not to activate using the empty syringe mode.

- PArA, press "CONFIRM"

  - If SU id, empty syringe mode activated.
  - If SU id, empty syringe mode deactivated.
  - Make your choice using the keys.



  - By validating once again, the configuration is memorised and it is possible to select another configuration .

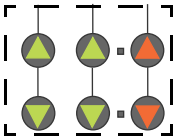
The modification may be cancelled by pressing the "STOP" key.

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

3.1.10 PArb, configuration of the frequency of preventive checks

This configuration enables users to select the maintenance frequency which lies between 1 and 9999 hours.

- PArb, press "CONFIRM"
  - The current value is displayed.
  - Display the new frequency value using the keys.
  - By validating once again, the new frequency is memorised and it is possible to select another configuration .



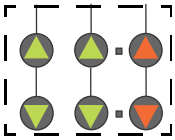
The modification may be cancelled by pressing the "STOP" key.

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

3.1.11 PArC, configuration of the drug display mode

This configuration enables users to choose whether or not to display the first four letters of the name of the drug used.

- PArC, press "CONFIRM"
  - If drUG, display activated, after validation of the syringe type, the operator should select the name of the drug used out of the choice of 15 names.
  - If nodr, display deactivated, the **Pilot** does not offer a choice of drug names.
  - Make your choice using the keys.
  - By validating once again, the configuration is memorised and it is possible to select another configuration .



If *The modification may be cancelled by pressing the "STOP" key.*

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

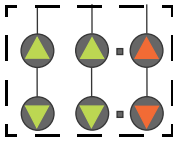
3.1.12 PArd, configuration of the Flanges detection mode

This configuration enables users to choose whether or not to activate the syringe flanges position check.

- PArd, press "CONFIRM"

  - ☐ If AiLE, detection activated, inappropriate positioning of the flanges is signalled by means of an alarm.
  - ☐ If noAL, no detection, the inappropriate positioning of the flanges is not checked.

  - ☐ Make your choice using the keys.



  - ☐ By validating once again, the configuration is memorised and it is possible to select another configuration .

The modification may be cancelled by pressing the "STOP" key.

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

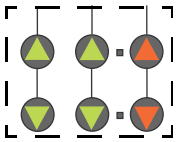
3.1.13 PArF, configuration of the bolus flow memorisation mode

This configuration enables users to select the bolus flow memorisation mode.

- PArF, press "CONFIRM"

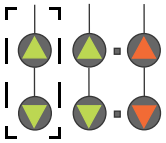
  - ☐ If nEn, bolus memorised, upon start-up of the **Pilot**, the bolus flow given corresponds to the last selected.
  - ☐ Si nonE, bolus not memorised, upon start-up of the **Pilot**, the bolus flow given is that defined by default.

  - ☐ Make your choice using the keys.



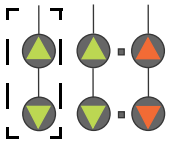
If the "not memorised" mode is selected, the bolus default value must be defined.

  - ☐ If the nonE is selected, the 50 cc LED lights up and the bolus flow is displayed.
    - ♦ Using the keys, enter the bolus value to be defined by default for a 50 cc syringe.



    - ♦ Press "CONFIRM" to memorise it

- ☐ The 20 cc LED lights up and the bolus flow is displayed.
  - ♦ Using the keys, enter the bolus value to be defined by default for a 20 cc syringe.



- ☐ By validating once again, the configuration is memorised and it is possible to select another configuration .

The modification may be cancelled by pressing the "STOP" key.

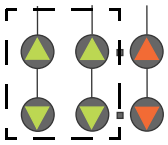
It is possible to exit the configuration mode at any time by pressing the "OFF" key.

3.1.14 PArG, configuration of the drugs list

This configuration enables users to enter the list of drugs that may be used by the **Pilot**.

- ■ PArG, press "CONFIRM"

  - ☐ The first four letters of the drug name are displayed.
    - ♦ The first letter flashes.
    - ♦ Modify the first letter using the "tens" or "units" keys.



  - ☐ Press "CONFIRM" to memorise it and move onto the next letter
  - ☐ When the last letter is validated, the next drug is displayed.
  - ☐ To validate the one or several modification(s), the entire list of drugs must be scrolled. When the last drug is validated, the PArG menu is displayed.

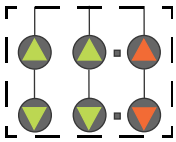
The modification may be cancelled by pressing the "STOP" key.

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

3.1.15 PArJ, configuration of the mains disconnection signal

This configuration enables users to choose whether or not to activate the power cut detection beep.

- PArJ, press "CONFIRM"
  - If SEC.t, detection activated, a power cut is signalled by a beep.
  - If noSi E, no detection.
  - Make your choice using the keys.



  - By validating once again, the type is memorised and it is possible to select another configuration .

OK

OK

The modification may be cancelled by pressing the "STOP" key.

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

STOP

OFF

3.1.16 PAr0, configuration of the date and time

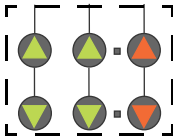
This configuration enables to enter the current date and time.

- Par0, press "CONFIRM"
  - Date adjustment (d/n/Y)

OK

d: day n: month Y: year

  - Make your choice using the keys.

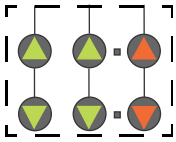


  - Press "CONFIRM"
  - Time adjustment

OK

H: hour n: minute

  - Make your choice using the keys.



  - Press "CONFIRM".

OK

It is possible to exit the configuration mode at any time by pressing the "OFF" key.

OFF

3.1.17 Typical syringe/details correspondence table

Brand	Capacity (ml)	Identification
BD Perfusion	50	BPf
BD Plastipak	50	BDk
BD Plastipak	20	BDk
Braun Omnifix	50	BrO
Braun Omnifix	20	BrO
Braun Perfusor	50	BrP
Braun Perfusor	20	BrP
Didactic Line France	50	DiL
Didactic Perfusion	50	DiP
Dispomed Spritze	50	Dis
Fresenius Injectomat	50	FrI
Fresenius P Spritze	50	FrP
Ivac	50	IVa
Map Gliss L L	50	MLL
Map Pic L L (Indolor)	50	MPL
Sherwood Monoject	50	SMJ
Sherwood Monoject	20	SMJ
Terumo	50	Trm
Terumo	20	Trm
Tutoject type T	50	TJT

3.2 Calibration menu

The calibration menu is reserved for authorised personnel only.
To determine the operation mode of the different calibrations, refer to the "Calibrations" chapter

This menu allows for calibration:

- CAL4 : of the three levels of battery voltage alarms.
- CAL6 : of the displacement potentiometer.

3.3 Service test menu

The service test menu is reserved for authorised personnel only. It enables users to perform a series of **Pilot** inspections to validate its efficient operation (see **"Checks"**chapter). This must be carried out each time parts are replaced.

The Service tests may also be performed more easily and more quickly using a PC with installed maintenance software (consult our After Sales Service).

The Service test menu enables users to perform a series of 16 tests or checks:

- tSt 1: Display of the running time and the maintenance date.
- tSt2: Indicator lights test.
- tSt3: Keyboard test.
- tSt4: Display of the battery voltage.
- tSt5: Display of the codes of the last 10 alarms.
- tSt6: Display of the total running time.
- tSt7: TTL serial link test.
- tSt8: RS 232 serial link test.
- tStA: Display of the software version.
- tStb: Display of the analogue input.
- tStC: Display of the plunger position.
- tStd: Buzzer test.
- tStE: Display of the calibration values.
- tStF: Display of the syringe type.
- tStG: Display of the syringe group.
- tStH: Display of the list of syringes.

4 Preventive maintenance

4.1 Recommendations

The **Pilot** syringe pump can only be checked, serviced or repaired by **Fresenius Vial** or by a certified and approved maintenance service. Any abnormal functioning of the pump must be brought to the attention of your in-house qualified technical personnel or our After-Sales Service.

Should you need to return the pump to our After-Sales Service, it should be cleaned, disinfected and very carefully packaged, preferably in its original packaging, before being sent.

For all information concerning the repair and use of the pump, kindly contact our After-Sales Service or our Sales department.

Fresenius Vial is not liable for loss or damage to the pump during its transport to our After-Sales Service.

4.2 Maintenance schedule

4.2.1 Preventive maintenance

In order to maintain the pump's performance, a Preventive Maintenance inspection must be carried out every 3 years. This procedure, which includes changing the battery, should be carried out by a qualified technician.

Any abnormal functioning or failure must be reported to the qualified technical staff in your organisation or to our After-Sales Service. In these instances, the pump should not be used.

Important: If these maintenance procedures are not observed, the pump's correct operation will be impaired.

4.2.2 Quality control

At the request of the health organisation, a quality check will be carried out every 12 months.

A quality check (not included in the guarantee) consists of different inspection procedures as defined in the pump's Technical Manual. Only a qualified technician may perform the quality check which must be performed using Fresenius-Vial software.

For more information, kindly contact our After-Sales Service.

At the end of the device life, return it to an organization competent in the treatment of the electrical an electronic equipment waste. Remove the battery from the device and return it to competent recycling organization.

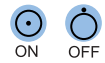
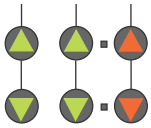
4.3 Checks

A checking certificate is available at the end of this chapter.

To ensure the check procedure is carried out efficiently, recharge the battery beforehand (16 hours).

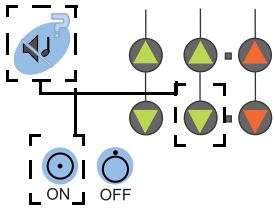
4.3.1 Test access

Keyboard description.

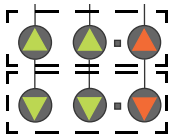
Key	Function
	**ON**, to switch the machine ON. **OFF**, to switch the machine off when pressed for over three seconds.
	SILENCE ALARM, to access the test mode.
	STOP, to cancel the test in progress.
	CONFIRM, to validate a choice.
	The selection keys allow to scroll the figures and letters on the tenths, units, tens segments etc.

Activate the Service test.

- Press "SILENCE ALARM" and "UNITS" keys simultaneously.
- Maintain this position while pressing "ON".



- When tSt. is displayed on screen, release selection of the "SILENCE ALARM" and "UNITS" keys, then validate within three seconds by pressing the "CONFIRM" key.
- By default, the equipment starts with test n°1 tSt. 1
- By using the selection keys, scroll the different tests on the display unit.



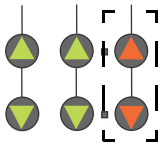
4.3.2 Visual check

Check the general appearance of the case and labels, and check for any traces of shock.

4.3.3 Running time and last servicing inspection date

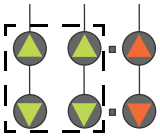
This test allows for display of the **Pilot** running time since its last servicing inspection. It also allows for display and modification of the "last" servicing inspection date. When the servicing inspection date is modified, the running time is reset.

■ tSt.1, press the "CONFIRM" key. OK
- □ If ...H: number of hours of use, 999 hours max.
- □ If ...d: number of days of use, 999 days max.
- □ If ...n : number of months, 999 months max. (average duration of one month considered as 30 days).
- □ If CtrL is displayed alternately, the result exceeds the max. servicing frequency memorised (see "PArb, Configuration of the frequency of preventive checks"): carry out preventive maintenance procedures.
  - ♦ By keeping the "tenths" keys pressed down, the number of times the equipment has been switched on is displayed.



■ Press "CONFIRM" again to display the date of the last servicing inspection. OK
- □ ..d, day of the servicing inspection date.
- □ Validate once again,
  - ♦ ..n, month of the servicing inspection date.
- □ By validating once again,
  - ♦ ...., year of the servicing inspection date.

Each time this information is read, the month, day and year of the servicing inspection date may be modified by using the tens and units keys. This date will be stored in the EEPROM and the running time will be reset.



- □ By validating once again, a different test may be selected. OK

The test may be stopped at any time by pressing the "STOP" key, and a different test may be selected. STOP

4.3.4 Indicator lights check

This test checks the efficiency of the indicator lamps, and the display units front panel.

■ tSt.2, press "CONFIRM". OK
- □ All LEDs and 7-segment display units are ON.
- □ By validating once again,
  - ♦ The LEDs and display units are scrolled one by one from left to right. (display of the LEDs, 7-segment display unit by segment and then by sets of 8).

The text is OK if all indicator lamps are lit up.

The test may be stopped at any time by pressing the "STOP" key, and a different test may be selected. STOP

4.3.5 Keyboard check

This test allows to check that all keyboard keys function correctly.

■ tSt.3, press "CONFIRM".

- ☐ The message CLAU is displayed.
- ☐ Keep each key pressed down, one by one,
  - ♦ Check the name of the key displayed on the display unit.

The name of each key is displayed as follows:

Display	Selected key
S IA.L	SILENCE ALARM
StoP	STOP
UAL	CONFIRM
boLu	BOLUS
S -..	+ tens
S.-.	+ units
S..-	+ tenths
S _..	- tens
S._.	- units
S _..	- tenths
UPEr	VOLUME INFUSED

If two or more keys are pressed simultaneously, the display unit shows "Err" and an audio alarm sounds "beep!beep!beep!" indicating an error.
The "OFF" key is not included in the keyboard check.

*The test may be stopped at any time by pressing the "CONFIRM" key for **over 3 seconds**, and a different test may be selected.*

4.3.6 Checking the battery voltage

This test enables users to display the battery voltage in Volts and tenths of a Volt.

■ tSt.4, press "CONFIRM". OK

□ The voltage is displayed in Volts.

□ By validating once again, a different test may be selected. OK

The test may be stopped at any time by pressing the "STOP" key, and a different test may be selected. STOP

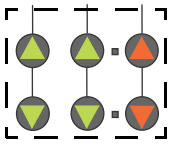
4.3.7 Display of the last 10 alarms

This test enables users to display the last ten **Pilot** alarms in the form of codes.

■ tSt.5, press "CONFIRM". OK

□ The most recent alarm code is displayed ---.0.

□ Press the keys to display the following codes from ---.1 to ---.9.



□ By validating once again, a different test may be selected. OK

The test may be stopped at any time by pressing the "STOP" key, and a different test may be selected. STOP

Alarm codes description:

Alarm	Description
A10	Battery alarm
A11	Syringe clamp alarm
A12	End of infusion alarm
A13	Limit volume alarm
A14	Disengagement alarm
A15	Piston head alarm
A16	Occlusion alarm
A17	Flanges alarm

Error codes description

Error	Description
10	Internal RAM anomaly
20	External RAM anomaly
30	Eprom anomaly
40	Access (E^2prom) Eeprom anomaly
50	Adc anomaly
60	Syringues parameters anomaly
70	Motor frequency anomaly
80	Keyboard matrix (key press non functioning) fault Electromagnetic disturbance exeeding standards
01	Rotation (absence top turn) error
E32	Error concerning segment advance control
E52	Error concerning advance during compensation for play.
E72	Error concerning advance over the whole length.
E82	Error concerning advance flow rate
E03	Error concerning communication
14	Period frequency anomaly
24	Rotation direction anomaly
34	Flow rate / motor period calculation anomaly
44	Incoherence quartz µC principal and µC secondary
55	µC secondary access fault
16	Date and time in µC secondary verification
56	Association condition output/step number
66	LCD Display time-out
18	Maximum infused volume reached
28	Language file incompatible
CFPC	Anomaly duringthe self set
COM	Communication error
CTRL	Preventive maintenance request

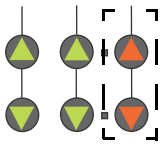
- Errors 10, 20, 30 and 40 cannot be stored in the EEPROM.
- If the **Pilot** switches off normally, the OFF message is displayed.
- If the **Pilot** switches off due to a malfunction, the OFF message is displayed with a flashing F.

4.3.8 Total operation time check

This test enables users to display the total running time of the **Pilot**. It is not possible to modify this time manually.

■ tSt.6, press "CONFIRM".

- ☐ If ___.H: number of hours of use, 999 hours max.
- ☐ If ___.d: number of days of use, 999 days max.
- ☐ If ___.M: number of months, 999 months max.
  (average duration of one month considered as 30 days).
  - By keeping the "tenths" keys pressed down, the number of times the equipment has been switched on is displayed.



- ☐ By validating once again, a different test may be selected.

The test may be stopped at any time by pressing the "STOP" key, and a different test may be selected.

4.3.9 TTL serial link test

This test enables users to check the efficiency of the TTL (80C32) serial link.

To perform this test, use plug on which lines Rx and Tx are short-circuited (2 and 3).

■ tSt 7, press "CONFIRM".

- ☐ LL is displayed at the start of the test.
  - If LLEr is displayed, the test is not successful, otherwise, the test is successful.

- ☐ By validating once again, a different test may be selected.

The test may be stopped at any time by pressing the "STOP" key, and a different test may be selected.

It is impossible to carry out this test when the PC is in communication with the **Pilot**. In this case, "OPEN" is displayed.

4.3.10 RS 232 serial link check

This test enables users to check the efficiency of the RS 232 (2691) serial link.

To perform this test, use plug on which lines Rx and Tx, RTS and CTS are short-circuited (2 and 3, 7 and 8).

- tSt8, press "CONFIRM". OK
  - noUA is displayed if the UART is missing, in which case the test cannot be carried out.
  - RTS andCTS line operation test.
    - If the test is unsuccessful, norC is displayed, in which case the test cannot be continued.
  - Lr is displayed.
    - If LrEr is displayed, the test is not successful, otherwise, the test is successful.
  - By validating once again, a different test may be selected. OK

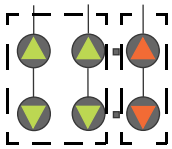
The test may be stopped at any time by pressing the "STOP" key, and a different test may be selected. STOP

It is impossible to carry out this test when the PC is in communication with the **Pilot**. In this case, "OPEN" is displayed.

4.3.11 Checking the software version.

Run this test to display the software version and revision numbers.

- tStA, press "CONFIRM". OK
  - eg. U09.8 is displayed:
    - 09, software version number.
    - .8, revision number
  - Press the tenths keys to display the EPROM checksum, e.g. 8d6F.
  - Press the other keys to display the software version index e.g. . A.
  - By validating once again, a different test may be selected. OK



The test may be stopped at any time by pressing the "STOP" key, and a different test may be selected. STOP

4.3.12 Checking the ADC

Run this test to read the result of the conversion of the five analogue inputs and three test inputs of the converter.

■ tSt.b, press "CONFIRM". OK

- ☐ The result displayed is the first of the five analogue inputs (from 0 to 4), example 3 18.0.
- ☐ The second type of result displayed corresponds to the converter test according to the channel number, ...L is the 0 test input, ...M is the mid-scale test input, and ...H is the ADC full scale test input.

Use the selection keys to move from one input to another.

- ☐ By validating once again, a different test may be selected. OK

Input	Name
0	Battery voltage
1	N.U.
2	Force sensor
3	N.U.
4	Potentiometer displacement
L	Converter zero test, between 0000 and 0004 if correct
M	Converter mid-scale test, between 01FB and 204 if correct
H	Converter full-scale test, between 03B and 3FF if correct

4.3.13 Checking the position sensor

This test enables users to display the plunger position in mm and 10^{ths} of a mm.

■ tSt.C, using spacers ref. T300940E and T300775G,

- ☐ Position the spacer ref. T300940E and press "CONFIRM".
  - ♦ in high position the display unit shows 115.0 ± 0,5 mm.
- ☐ Position the spacer ref. T300775G and press "CONFIRM".
  - ♦ in low position the display unit shows 20.0 ± 0,5 mm.

- ☐ By validating once again, a different test may be selected. OK

If the value is out of limits, recalibrate the position sensor (see "EtA.6 Position sensor calibration.").

4.3.14 Buzzer test

Run this test to check that the buzzer is working.

■ tSt.d, press "CONFIRM".

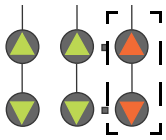
- ☐ The buzzer sounds continuously and the bEEP message is displayed.
- ☐ By validating once again, a different test may be selected.

4.3.15 Display of the calibration values

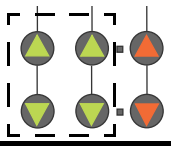
Run this test to display the calibration values stored in the EEPROM.

■ tSt.E, press "CONFIRM".

- ☐ bAt.1 is displayed alternately with its calibration value.
  - ♦ Press one of the tenth keys to display the number of calibrations carried out for this value



- ☐ Press one of the unit or tenth keys to move onto another value.



Display	Name
bAt.1	Alarm and pre-alarm battery voltage 6.3 V
bAt.2	Pre-alarm battery voltage 5.9 V
bAt.3	Alarm battery voltage 5.7 V
HIG.H	Displacement potentiometer with large 115.0 mm spacer
Lou	Displacement potentiometer with small 20.0 mm spacer
0.G	Force meter with 0 kg
5t.G	Force meter with 5 kg

4.3.16 Checking the syringe clamp

This test displays the type of syringe fitted to the **Pilot**.

■ tSt.F, press "CONFIRM" key

Using a 50 cc and 20 cc capacity syringe or the T301521 spacer.

- ☐ Place the syringe clamp in the higher position.
  The display unit shows ---.-
- ☐ Fit the 50 cc syringe. The display unit shows 50c.c
- ☐ Fit the 20 cc syringe. Thedisplay unit shows 20c.c
- ☐ Place the syringe clamp in the lower position.
  The display unit shows ---.-

Capacities which are non-existent or non-configured in the EEPROM are displayed in the form of ---.-.

- ☐ By validating once again, a different test may be selected.

4.3.17 Checking the syringe group number

Run this test to determine for which list of syringes the instrument has been configured.

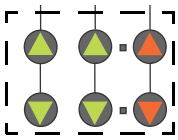
■ tSt.G, press "CONFIRM".

- ☐ The syringe group number configured in EEPROM is displayed, example G01.
- ☐ By validating once again, a different test may be selected.

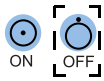
4.3.18 Checking the list of syringes

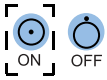
This test enables users to display the list of syringes programmed in the **Pilot**.

■ tSt.H, press "CONFIRM".

- ☐ The syringe capacity is displayed and the corresponding Led lights up.
- ☐ Each time a key is pressed:
  - The syringe details are displayed.
  - The Led corresponding to the details lights up.
  - The one or several Led(s) corresponding to the capacities lights up. 
- ☐ Press stop to select a different test.

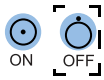
4.3.19 Checking the disengagement

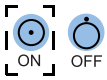
To carry out this operation, exit the test mode and press "OFF". 

■ Press "ON". 

- ☐ Lift the disengagement lever.
  - Check for presence of the mechanical disengagement alarm (red Led at the end of the syringe diagram).
- ☐ Fit the device with the 50 cc syringe, ensuring the flanges and plunger are in position.
- ☐ Release the disengagement lever.
  - Ensure there is no mechanical lever release alarm.
  - Check plunger locking.

4.3.20 Checking the flanges detection system

To carry out this operation, exit the test mode and press "OFF". 

■ Press "ON". 

- ☐ Fit the device with the 50 cc syringe, ensuring the flanges and plunger are in position.
- ☐ Ensure the syringe is detected appropriately eg. 50c.c.
- ☐ Place the syringe in the device ensuring the flanges is out of the groove.
- ☐ Fit the syringe clamp and plunger correctly.
- ☐ Make sure the light alarm flashes, locating the problems on the syringe diagram.

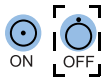
4.3.21 Checking the syringe head detection system

This check must be carried out for every syringe provided with the instrument.

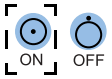
- Check the functionality.
  - Free play, without end play or dismounting of this.
- Check for alarm presence with:
  - Syringe head detection arm in the upper position.
  - Syringe head detection arm in the lower position.

Ensure there is no alarm in presence of spacers or 20 cc and 50 cc syringes.

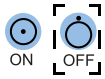
- Using spacers ref. T301518 and T301519.
  - To carry out this operation, exit the test mode and press "OFF",



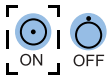
  - Press "ON".
  - Fit the instrument with the spacer ref T301518 and lock it into position using the syringe clamp.
    - Place the syringe plunger against the spacer with the syringe head detection arm on the spacer.
    - 20c.c is displayed without triggering the alarm.
  - Fit the instrument with the spacer ref T301519 and lock it into position using the syringe clamp.
    - Place the syringe plunger against the spacer with the syringe head detection arm on the spacer.
    - 50c.c is displayed without triggering the alarm.



- Using 20cc and 50cc syringes.
  - To carry out this operation, exit the test mode and press "OFF",

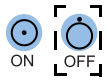


  - Press "ON".
  - Fit the instrument with the 20 cc syringe and lock it into position using the syringe clamp.
    - Place the syringe plunger against the syringe with the syringe head detection arm on the syringe plunger.
    - 20c.c is displayed without triggering the alarm.
  - Fit the instrument with the 50 cc syringe and lock it into position using the syringe clamp.
    - Place the syringe plunger against the syringe with the syringe head detection arm on the syringe plunger.
    - 50c.c is displayed without triggering the alarm.

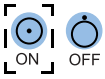


4.3.22 Checking backpressure

To carry out this operation, exit the test mode and press "OFF",



- Press "ON".



  - Fit the instrument with the 50 cc syringe and lock it into position using the syringe clamp, ensuring the flanges and plunger are correctly positioned.
  - Place the manometer (or any other pressure measurement device) at the syringe outlet.
  - Select a 50 ml "B-D PLASTIPAK" syringe by pressing "CONFIRM".

  - Check the position of the backpressure adjustment button.

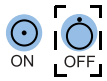
  - Select a maximum flow rate and initiate the infusion by pressing the "CONFIRM" key.

    - Ensure there is no acoustic and visual alarm (backpressure Led off).
    - Check that the infusion Leds are flashing.
    - Ensure the alarm is triggered for a value of 0,7 bar ± 0,1 bar.
  - Stop the infusion cycle by pressing the "STOP INFUSION" key.

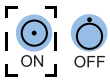
  - Repeat the test setting the backpressure level to the minimum and maximum levels.
    - Min. backpressure = 0,4 bar ± 0,1 bar.
    - Max. backpressure = 1.2 bar ± 0.2 bar.

4.3.23 Checking the pre-alarm and end of infusion alarm

To carry out this operation, exit the test mode and press "OFF",

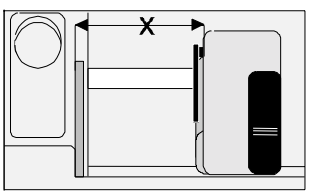


- Press "ON".



  - Fit the device with the syringe, ensuring the flanges and plunger are in position.
  - Ensure the syringe is detected appropriately eg. 50c.c .
  - Select a "B-D PLASTIPAK" syringe filled to 20 ml.
  - Select a flow rate of 120 ml/h.
    - For normal flow rates, the pre-alarm is activated 5 minutes before end of infusion.
    - Flow rate example: > 50 ml/h, the pre-alarm is activated when the remaining volume equals 10% of the total syringe capacity.
    - Ensure the end of infusion pre-alarm is present.

  - Press the "SILENCE ALARM".
    - The acoustic alarm is silenced and the visual signal is maintained.
  - Measure the "hard height" at "end of infusion".
    - 18,5 ≤ x ≤ 19,5.



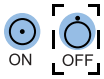
Top view

For accurate checking of the "hard height", do not move the plunger when measuring.

If the "hard height" reading is out of limits, recalibrate the position sensor (see "EtA.6 Position sensor calibration.").

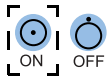
4.3.24 Checking the linearity

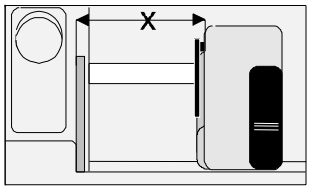
To carry out this operation, exit the test mode and press "OFF",



- Equipment required: Chronometer, calliper square, BD Plastipak 50 ml syringe.

- Press "ON".
  - ☐ Fit the device with the "B-D PLASTIPAK" 50 ml syringe, ensuring the flanges and plunger are in starting position.
  - ☐ Measure the distance X1 in mm.





Top view

  - ☐ Ensure the syringe is detected appropriately eg. 50c.c .
  - ☐ Select a "B-D PLASTIPAK" syringe filled to 50 ml.
  - ☐ Select a flow rate of 50 ml/h.
  - ☐ Press "CONFIRM" to start infusion and simultaneously start the chronometer

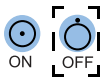
  - ☐ At 50 minutes, stop the infusion by pressing "STOP" and measure the distance X2.

  - ☐ Ensure X = X1 - X2 lies between 74,96 mm ≤ X ≤ 76,47 mm.

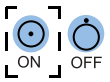
For accurate checking of the linearity do not move the plunger when measuring.

4.3.25 Checking mains/battery operation

To carry out this operation, exit the test mode and press "OFF",



- Connect the device to a mains supply and press "ON".
  - ☐ Check the operation of the mains presence Led (indicator in the shape of a plug).



- Disconnect the device from the mains.
  - ☐ Check the mains power LED is "OFF" and the battery LED is "ON".

4.3.26 Battery autonomy test

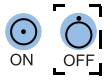
- Recharge the battery for 16 hours.
- Disconnect the device from the mains power.
  - Fit the unit with 50 CC syringe then validate..
  - Select a flow rate of 120ml/h then validate..

- Check the battery autonomy is higher than 1 hour.

4.3.27 Continuity test

Using a multimeter.

To carry out this operation, exit the test mode and press "OFF",



- Connect the multimeter to an ohmmeter.
  - Check the electrical resistance shown by the ohmmeter is over 10 MΩ :
    - between phase and metal tube.
    - between neutral and metal tube.

4.3.28 Quality Control Certificate

Use this table to note the results of the different tests.

These tests can be done with dedicated **Pilot** software.

Equipment type:	Code:	Equipment series N°:

N°	Procedure	Resulting value	Conformity Yes	Conformity No
1	■ Check the general condition of the case and its labels.			
2	■ Display total running time, tSt 1 (in hours, days or months):**********	.....		
3	■ Display the last servicing inspection date, tSt 1 (in days, months or years):**********	.....		
4	■ Check all indicator lights, tSt2.			
5	■ Check the keyboard, tSt3.			
6	■ Display the total running time, tSt6 (in hours, days or months):**********	.....		
7	■ Check the position sensor, tStC: ☐ High position with T300940 spacer, check that the displayed value is 115.0 ± 0.5 mm: **********	....		
8	■ Check the syringe clamp, tStF: ☐ Syringe clamp in high position, check that the displayed value is ---.- :********** ☐ Fit the device with a 50 cc syringe or a T301521 spacer, check that the value displayed is 50c.c :********** ☐ Fit the device with a 20 cc syringe or a T301521 spacer, check that the value displayed is 20c.c :********** ☐ Syringe clamp in low position, check that the displayed value is ---.- :**********	....		
9	■ Check the list of programmed syringes, tStH.			
10	■ Check the anti-siphon arm: ☐ Free travel without end play. ☐ Presence of the alarm in high and low position. ☐ No alarm in presence of 20 cc and 50 cc syringe piston.			
11	■ Check the backpressure (use a **Fresenius Vial** dynamometer): ☐ Position of adjustment knob 0.6 ≤ X bar ≤ 0.8: **********			

N°	Procedure	Resulting value	Conformity Yes	Conformity No
12	■ Check the linearity (60 cc BD Plastipack): ☐ Measure the plunger distance, X1 mm:********** ..... ☐ Measure the plunger distance after 50 mn pump running, X2 mm:..... ☐ Ensure 74,96 ≤ X1-X2 mm ≤ 76,47:**********			
13	■ Check the presence end of infusion pre-alarm.			
14	■ Check the end of infusion alarm: ☐ With a 60 cc BD, check that the hard height distance is 18,5 ≤ x mm ≤ 19,5: **********			
15	■ Check the battery autonomy: ☐ Recharge the battery for 16 hours. ☐ Operate the **Pilot** for 1 hr at a flow rate of 120 ml/hr:*********			
16	■ Carry out the electrical tests according to standard EN 60601-1			

Name:	**Date:**	**Signature:**

Comments:

4.4 Flow rate control

4.4.1 Measurement with a computer

ISDébit software is required for measuring the flow with a computer. This software is the property of **Fresenius Vial**. Please contact our After Sales Service for any further information.

The operation mode defined by this software follows the standard EN-60-601-2-24 for **infusion pumps.** It is up to the user to adapt this procedure to the software used.

*In order to purchase the ISDébit flow rate control software, contact the **Fresenius Vial** customer service.*

The test procedure defined below must be carried out using a 50 ml or 20 ml syringe.

Equipment required

- Scales coupled to a microcomputer:

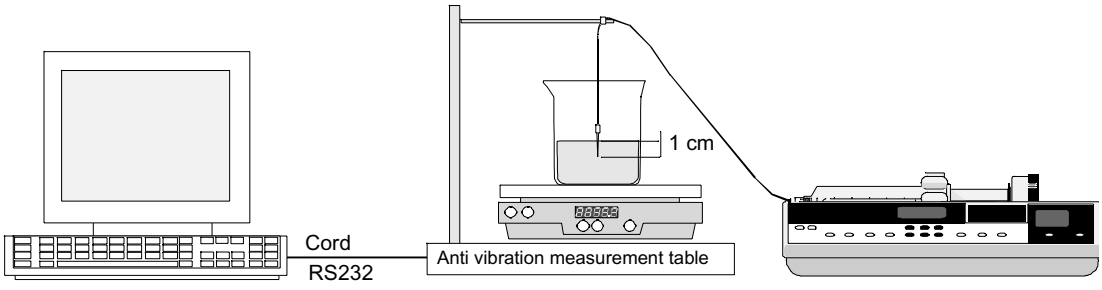
Flow rate value	Scales sensitivity
x ≤ 5 ml/hr	1/10000th
5 ml/hr < x ≤ 30ml/hr	1/1000th
x > 30 ml/hr	1/100th

- Multi scales acquisition programme.
- Test tube or beaker with 1 ml graduating
- Liquid: distilled water and oil
- Luer lock type plastic syringe (50 or 20 ml).
- Catheter extension with Luer Lock (length 100 cm, inside diameter 2,5 mm).
- Needle:

Flow rate value	Needle type
x ≤ 30ml/hr	G26
x > 30 ml/hr	G18 or G21

Installation

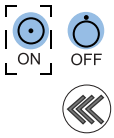
- According to the installation drawings shown below.



Make sure the horizontal installation plane is respected.

- Fill the syringe with 50 ml of distilled water.
  - Prime to eliminate any air bubbles.
- Secure the female Luer Lock end piece of the catheter extension onto the syringe and the male Luer lock end piece onto the needle.
- Fit the syringe onto the device.
- Fill the test tube ensuring the needle is dipped in the liquid (> 1 cm).
  - Add several drops of oil to create a greasy film on the surface of the liquid. This way the user will avoid any measurement error due to evaporation of the liquid.
- Place the test tube in the centre of the scales platform.
- Place the needle inside the test tube.

The infusion line (needle/catheter extension) must not rest on the scales/test tube assembly.



- Press "ON" (device in mains supply mode).
  - Prime the infusion line using the "BOLUS" key.
  - Check that there are no air bubbles.

Operating mode

The software works following the operating mode described in the EN-60-601-2-24 standard for ***infusion pumps.***

- Start the acquisition programme for the scales.
- Enter the necessary data to launch the programme without validating the flow rate.
- Adjust the scales to the specified flow rate.
- Confirm the flow rate on the microcomputer so that the automatic setting of the scales can take place.
- Start the infusion by pressing the "CONFIRM" key, when 00.00 appears on the scales display screen.

- When the specified time is over, note the error percentage displayed on the screen.

4.4.2 Measurement with scales

Equipment required

- Stop clock
- Scales

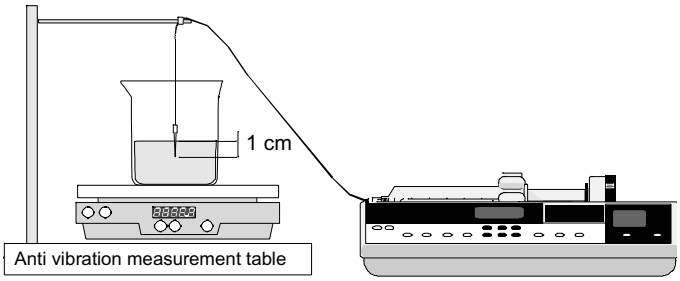
Flow rate value	Scales sensitivity
x ≤ 5 ml/hr	1/10000th
5 ml/hr < x ≤ 30ml/hr	1/1000th
x > 30 ml/hr	1/100th

- Test tube or beaker with 1 ml graduating
- Liquid: distilled water and oil
- Luer lock type plastic syringe (50 or 20 ml)
- Catheter extension with Luer Lock (length 100 cm, inside diameter 2,5 mm).
- Needle:

Flow rate value	Needle type
x < 30ml/hr	G26
x > 30 ml/hr	G18 or G21

Installation

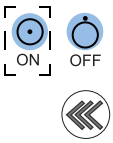
- According to the installation drawings shown below.



Make sure the horizontal installation plane is respected.

- Fill the syringe with 50 ml of distilled water.
- Prime to eliminate any air bubbles.
- Secure the female Luer Lock end piece of the catheter extension onto the syringe and the male Luer lock end piece onto the needle.
- Fit the syringe onto the device.
- Fill the test tube ensuring the needle is dipped in the liquid (> 1 cm).
- Add several drops of oil to create a greasy film on the surface of the liquid. This way the user will avoid any measurement error due to evaporation of the liquid.
- Place the test tube in the centre of the scales platform.
- Place the needle inside the test tube.

The infusion line (needle/catheter extension) must not rest on the scales/test tube assembly.



- Press "ON" (device in mains supply mode).
  - ☐ Prime the infusion line using the "BOLUS" key.
  - ☐ Check that there are no air bubbles.

Operating mode

- Select a flow rate.

For low flow rates (< 5 ml/hr), validate and wait for the infusion to stabilise for 1 hour. For higher flow rates, wait for 10 to 30 minutes after infusion.

- Set the scales at 00.00 g.
- Start infusion by pressing the "CONFIRM" key, and start the stop clock at the same time, (if necessary make a note of the stop clock start value).
- Press the "STOP INFUSION" key to stop the test one hour later.
- Note the value in grams of the “infused” liquid.
- Calculate the difference between the design value and the real value.

1 gram = 1 ml.

- The error percentage can be calculated from this difference :

$$\frac{(\text{Real value} - \text{Design value})}{\text{Design value}} \times 100 = \text{Error percentage}$$

4.4.3 Measurement using a test tube

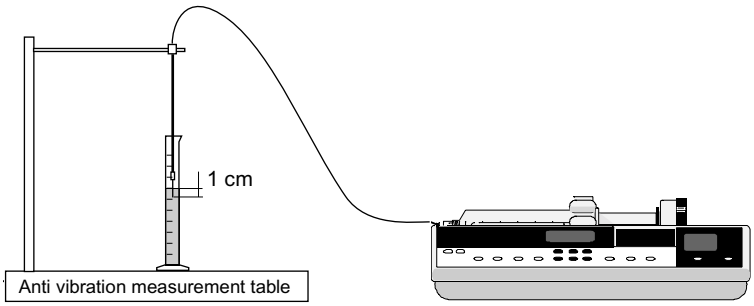
Equipment required

- Stop clock.
- Test tube or beaker with 1 ml graduating
- Liquid: distilled water and oil
- Luer lock type plastic syringe (50 or 20 ml)
- Catheter extension with Luer Lock (length 100 cm, inside diameter 2,5 cm).
- Needle:

Flow rate value	Needle type
x < 30ml/hr	G26
x > 30 ml/hr	G18 or G21

Installation

- According to the installation drawings shown below.



Make sure the horizontal installation plane is respected.

- Fill the syringe with 50 ml of distilled water.
  - ☐ Prime to eliminate any air bubbles.
- Secure the female Luer Lock end piece of the catheter extension onto the syringe and the male Luer lock end piece onto the needle.
- Fit the syringe onto the device.
- Fill the test tube ensuring the needle is dipped in the liquid (> 1 cm).
  - ☐ Add several drops of oil to create a greasy film on the surface of the liquid. This way the user will avoid any measurement error due to evaporation of the liquid.
  - ☐ Place the needle inside the test tube.

Operating mode

- Select a flow rate.

For low flow rates (< 5 ml/hr), validate and wait for the infusion to stabilise for 1 hour. For higher flow rates, wait for 10 to 30 minutes after infusion.

- Start infusion by pressing the "CONFIRM" key, and start the stop clock at the same time, (if necessary make a note of the stop clock start value).

- Once the whole infused syringe is in the test tube, calculate the difference between the design value and the real value:
  Real flow rate = 50 ml/time in hours
- The error percentage can be calculated from this difference :

$$\frac{(\text{Real value} - \text{Design value})}{\text{Design value}} \times 100 = \text{Error percentage}$$

4.5 Cleaning and disinfecting

The pump form part of the patient's immediate environment. It is advisable to clean and disinfect the device's external surfaces of the device on a daily basis in order to protect patient and staff.

- Disconnect the pump from its mains supply before cleaning.
- Do not place in an AUTOCLAVE nor IMMERSE the device, Do not let liquids enter the device's casing.
- If the device is placed in a high contamination risk unit, it is advisable to leave it in the room during disinfecting, after having disinfected it with amoist cloth.
- Use a cloth soaked in DETERGENT-DISINFECTANT, previosly diluted with water if required, to destroy micro organisms.
  - Avoid abrasive scrubbing which could scratch the casing.
  - Do not rinse or wipe the surfaces.

Do not use :

- ¨TRICHLOROETHYLENE-DICHLOROETHYLENE
- AMMONIA.
- AMMONIUM CHLORIDE
- CHLORINE AND AROMATIC HYDROCARBON.
- ETHYLENE DICHLORIDE-METHYLENE
- CHLORIDE-CETONE

These aggressive agents could damage the plastic parts and cause device malfunction.

Take car also with ALCOHOL based SPRAYS (20% -40% alcohol) .They lead to tarnishing and small cracks in the plastic, and do not provide the neceeeary cleaning prior to disinfection.

Disinfecting SPRAYS may be used, in accordance wih the manufacturer recommendation, from a distance of 30 cm of the device, avoid the accumulation of the product in liquid form.

Avoid iodine-based solutions that may result in coloring some plastic parts permanently.

Please contact the appropriate service, responsible for cleaning and disinfecting products, in your establishment for further details.

4.6 Storage

The device should be stored in a dry, cool place. In case of prolonged storage, the battery should be disconnected via the battery access flap situated underneath the device.This should be done by a qualified technician

- Storage conditions and carrying:
  - Temperature: -10°C to 60°C / 14°F to 140°F.
  - Atmospheric pressure: 500 hPa to 1060 hPa.
  - Humidity: 10% to 90%, no condensation.

- Use conditions:
  - Temperature: 5°C to 40°C / 41°F to 104°F.
  - Atmospheric pressure: 700 hPa to 1060 hPa.
  - Humidity: 20% to 90%, no condensation.

Fully recharge the battery before using the equipment to avoid any risks caused by micro power cuts in the mains supply and to ensure maximum autonomy.

5 Diagnostic

5.1 Troubleshooting guide

Problems	Causes	Solutions
End of infusion detected too early (at approximately 10 ml). No end of infusion pre-alarm or alarm.	■ The installed syringe doesn't correspond with the syringe selected.	■ Replace or validate the right syringe brand. ■ Recalibrate the position sensor (Eta6) or with IS control software.
Flow rate or displacement control drift.	■ The installed syringe doesn't correspond with the syringe selected. ■ The position sensor calibration values have drifted.	■ Replace or validate the right syringe brand. ■ Check the position sensor calibration values and recalibrate it if necessary. ■ Change the position sensor.
Occlusion alarm after the Pilot has been turned on.	■ Wrong calibration of the force sensor. ■ Force sensor out of order. ■ Flexible circuit cut.	■ Recalibrate and check the force sensor. ■ Replace the force sensor. ■ Replace the flexible circuit.
Occlusion alarm during the infusion.	■ The pressure limit selected is too low. ■ Wrong calibration of the force sensor. ■ Flexible circuit cut.	■ Select a highter pressure limit. ■ Recalibrate and check the force sensor. ■ Replace the flexible circuit.
Disengagement alarm after the Pilot has been turned on or during the infusion.	■ The disengagement micro-switch is defective. ■ Flexible circuit cut.	■ Replace the micro-switch. ■ Replace the flexible circuit.
Plunger head position alarm unjustified.	■ Optical switch and/or, anti-siphon cam obturator are defective. ■ Flexible circuit cut.	■ Check the anti-siphon system ■ Check the good condition of the pusher cover internal mechanism. ■ Replace the flexible circuit.
Syringe clamp alarm injustified	■ Optical switchs and/or, syringe clamp obturator are defective. ■ Micro-switch and/or syringe flanges detection conection are defective.	■ Check the syringe clamp and replace the defective parts, if necessary.
Display defect: LED's, 8 segments display units	■ Control transistors, LED's and/or display connection are defective	■ Chek the good condition of the display board. ■ Replace the LED's or the control transistors. ■ Check the display boad. ■ Check the connectors which link CPU and display boards.
The Pilot turns off when it is disconnected from the mains powers.	■ Battery fuses is out of order. ■ The battery is unplugged or the battery cable is cut. ■ Battery is totally discharged	■ Replace the battery fuse. ■ Check the battery connection. ■ Replace the battery

Problems	Causes	Solutions
The power supply LED doesn't lit.	■ Power supply fuse is out of order.	■ Replace the power supply fuse.
Battery alarm while it has been completely charged.	■ Voltage regulator MAX 652 is defective (charging voltage greater than 10 V or lower than 5 V). ■ Wrong calibration of the battery. ■ Battery is totally discharged.	■ Check the battery charge voltage and replace the regulator if necessary. ■ Recalibrate the 3 battery voltage levels with IS contol software. ■ Replace the battery.
Battery alarm while the Pilot is connected to the mains power supply.	■ The battery voltage calibration was made while the Pilot was connected to the mains power supply.	■ Recalibrate the 3 battery voltage levels with IS contol software. ■ Recalibrate the 3 battery voltage levels with a stabilisad power supply adjusted at 9 volts in order to set the device to CFPC or ETAL modes. ■ Replace the CPU board and carry on a complete configuration of the device.
The Pilot turns "ON" or turns "OFF" alone.	■ Keyboard is defective. ■ Power supply board is defective.	■ Check and replace the keyboard if necessary. ■ Check that there was no liquid infiltration under the power supply board relay. ■ Check the relay and replace it if necessary. ■ Check the relay transistors control and replace them if necessary. ■ Replace the power supply board.
Some keys of the keyboard keys don't work.	■ Keyboard is defective.	■ Check the keyboard (test3) Replace the keyboard if necessary.
After a fall	■ Mechanical elements damaged	■ Check that the centering ring, the mechanical assembly and the cases are intact.

5.2 Error messages

Error code	Description	Recommended action
Er 10	■ Internal RAM anomaly	■ Reconfigure the Pilot with IS Control software. ■ Replace the CPU board and carry on a complete configuration of the device.
Er20	■ External RAM anomaly	
Er30	■ EPROM anomaly	
Er40	■ EEPROM anomaly	
Er50	■ ADC anomaly	■ Check the ADC. ■ Check the compatibility between the power supply and the CPU Boards. See PM0084. ■ Replace the power supply board. ■ Replace the CPU board and carry on a complete configuration of the device.
Er60	■ Syringes parmetters anomaly	■ Reconfigure the Pilot with IS Control software. ■ Replace the CPU board and carry on a complete configuration of the device.
Er70	■ Motor frequency anomaly	
Er80	Keyboard anomaly	■ Check and replace the keyboard if necessary. ■ Check that there is not liquid presence inside the Pilot that could damage keyboard and electronics booards. ■ Replace the CPU board and carry on a complete configuration of the device.
	■ Electromagntic disturbance exceeding standards limits	■ Check the Pilot environment
Er01	■ Motor rotation error	■ Check that there is no foreign body in the mechanical gear box. ■ Check the good condition of the rotation optical switch and the motor rotation disk. ■ Check that the motor rotates when it isn't mounted on to the gear box. ■ Replace the motor. ■ Replace the gear box. ■ Replace the power board.

Error code	Description	Recommended action
Er 32	■ Displacement error on a short distance.	■ Check the position sensor attachement. ■ Check the position sensor calibration. ■ Check the ADC. ■ Check the position sensor and replace if necessary. ■ Reconfigure the Pilot with IS Control sofware.
Er 52	■ Displacement error during the compensation.	
Er 72	■ Displacement error on the whole lenght.	
Er 82	■ Displacement error in relation to the flow rate.	
Er 14	■ Motor period calculation anomaly	■ Reconfigure the Pilot with IS Control software. ■ Replace the CPU board and carry on a complete configuration of the device.
Er 24	■ Motor rotation direction anomaly	■ Check the motor rotation sensor. ■ Replace the CPU board and carry on a complete configuration of the device.
Er 34	■ Flow rate / Motor period calculation anomaly	■ Reconfigure the Pilot with IS Control software. ■ Replace the CPU board and carry on a complete configuration of the device.
Er 44	■ Quartz freqency anomaly	■ Replace the quartz. ■ Replace power supply board.
Er 55	■ Time clock access	■ Replace power supply board.
Er 16	■ Time clock fault	■ Check the time clock ■ Replace the CPU board and carry on a complete configuration of the device.
Er 56	■ Software anomaly	■ Reconfigure the Pilot with IS Control software.
Er 66	■ LCD time-out.	■ Replace the display board.
Er 18	■ Maximum infused volume reached.	■ Restart the pilot.
Er 28	■ Imcompatible language file.	■ Reconfigure the Pilot with IS control software.
CFPC	■ Anomaly during the self-test	■ Reconfigure the Pilot with IS Control software. ■ Replace the CPU board and carry on a complete configuration of the device.
COM	■ Comunication error	■ Check the connection with the computer Master.

Error code	Description	Recommended action
CtrL	■ Preventive maintenance request	■ Perform the regular servicing checks and update the maintenance date (test1) ■ This error doesn't jam the Pilot. Press confirm to leave

*: When the device is switched off and the EEPROM is rewritten, the checksum is rewritten in the memory to save the settings.
If the hardware downtime is longer than the software downtime, the device is switched off before the EEPROM is completely written: Non-conforming checksum.
Er(-)0 or CFPc: When the device goes into CFPc, you must reconfigure it: WATCH DOG faulty.

6 Operation sheets

This chapter lists the set of dismounting/remounting sheets.

N°1, Procedure: Display and central unit boards

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 antistatic wriststrap.

Maintenance level:

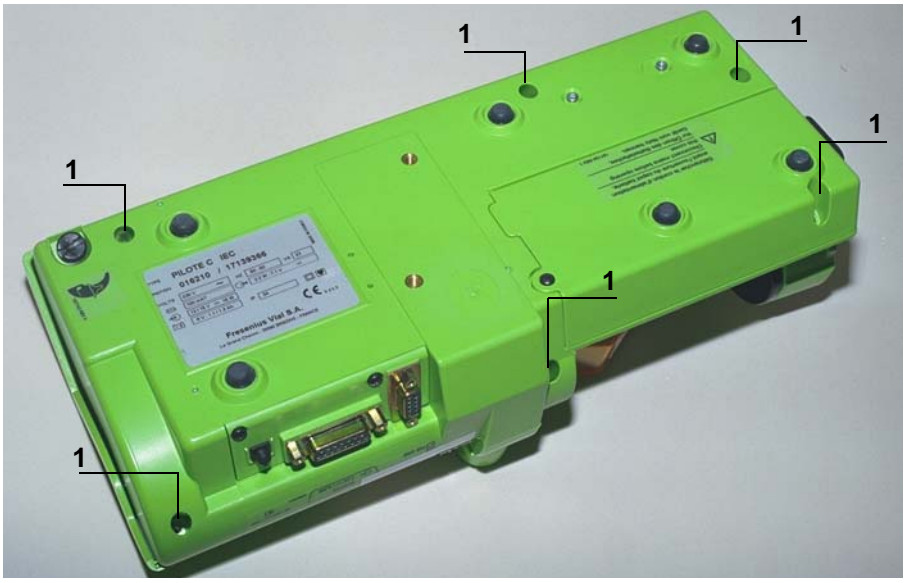
Level 3, specialised technician (see documentation on biomedical training).

Procedure:

Access

- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case making sure the CPU board flat jumper is not accidentally removed in the process.
- Disconnect the CPU board flat jumper.

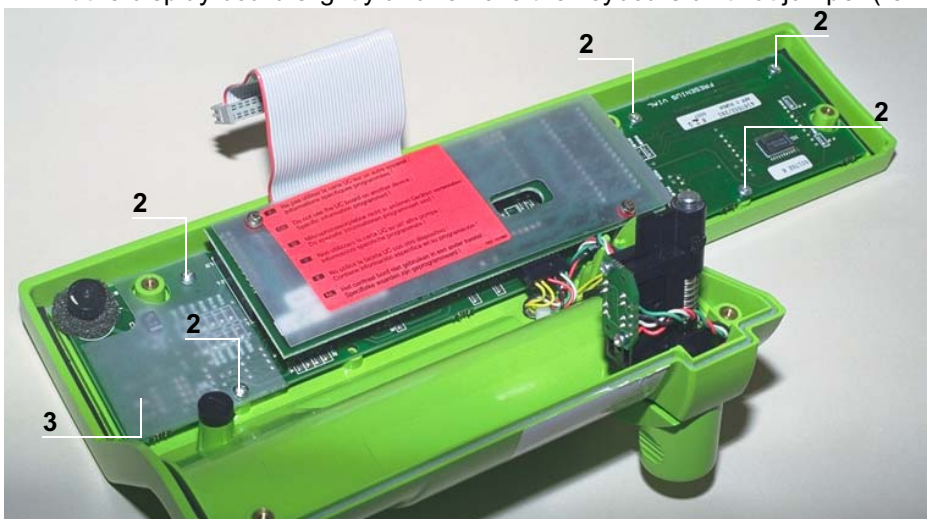
Hands must not come into contact with the CPU boards.

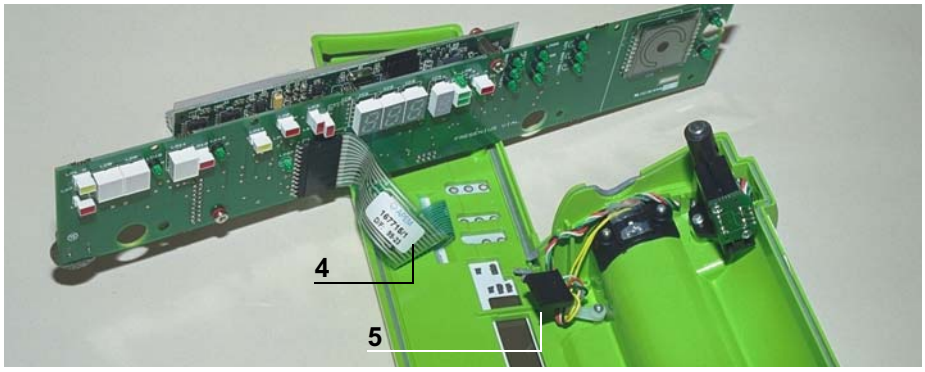


Dismounting

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

- Unscrew the 5 Phillips head screws (ref. 2) located at the display board, which link this to the upper case.
- Remove the board insulator (ref. 3) located on the left.
- Disconnect the black connector (ref. 5).
- Lift the display board slightly and remove the keyboars unit flat jumper (ref. 4).





Remounting

*A specific type of board corresponds to each **Pilot** "CPU board" ; It is important to avoid reversing the references between each **Pilot** and order the part number corresponding to your device.*

Carry out the same procedures in reverse to reassemble the parts.

When mounting the display board, it is important to reduce the torque in the plastic inserts so as to avoid causing damage to these.When fitting the upper case, ensure the joint is perfectly positioned in its slot after reassembly.

- When a remplacement of the CPU board by a new one, a complete configuration is necessary using IS control maintenance software.
- Perform the regular servicing checks (see "Quality Control Certificate").

N°2, Procedure: Syringe clamp

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 Posidriv Z1 flat screwdriver.

Maintenance level:

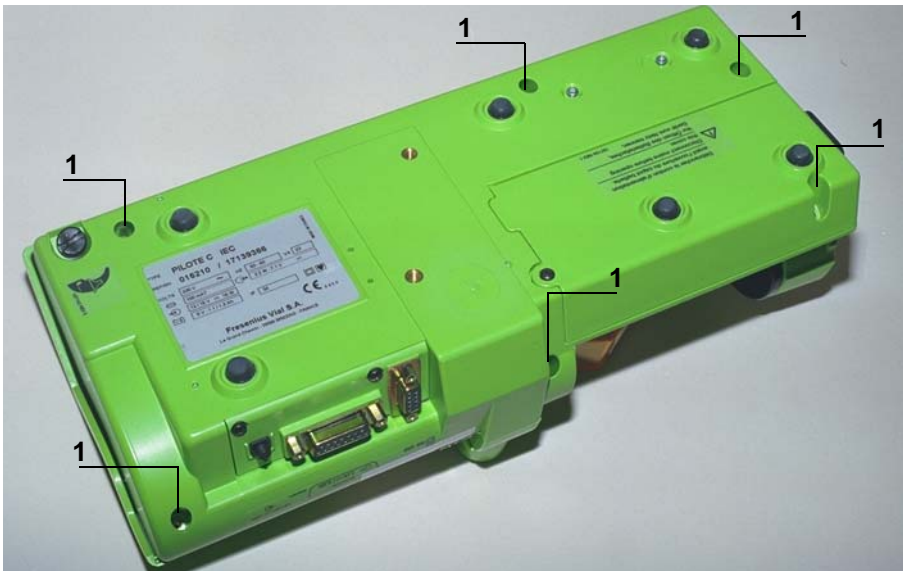
Level 2, specialised technician (see documentation on biomedical training).

Procedure:

Access

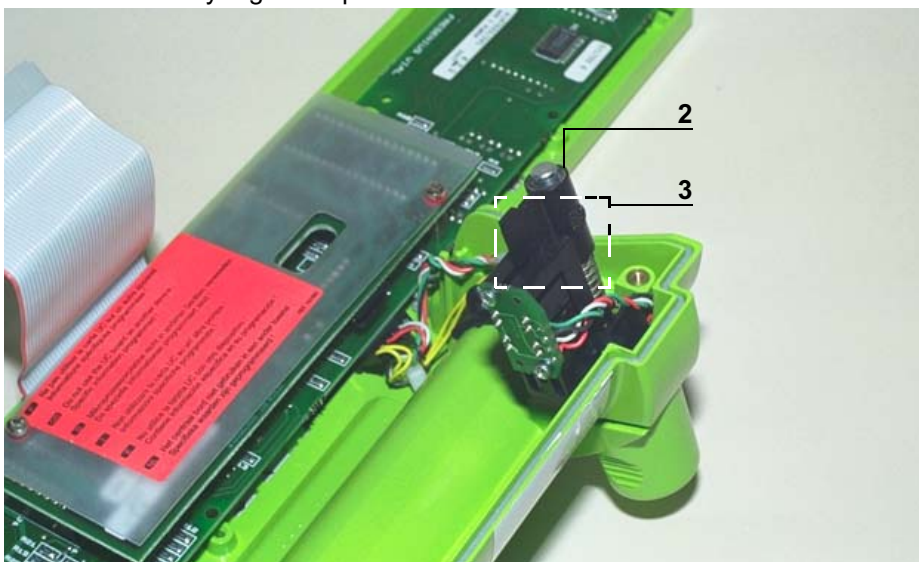
- Turn the **Pilot** over onto the upper case.
- Unscrew the 5 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case.
- Disconnect the CPU board flat cable.

Hands must not come into contact with the CPU boards.



Dismounting

- Remove the spring retaining ring (ref. 2) located on the syringe clamp shaft, which holds this to the CPU support.
- Remove the obturator and the spring (ref. 3).
- Remove the syringe clamp.



Reassembly

Carry out the same procedures in reverse to remount the unit.

When fitting the upper case, ensure the joint is perfectly positioned in its slot after reassembly.

- Perform the regular servicing checks (see "Quality Control Certificate").

N°3, Procedure: Syringe detection system

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 antistatic wriststrap.
- 1 soldering iron
- "RADIEL Sn60Pb RI 1" welding wire (cleaning not required for rewelding) or equivalent.
- Silicone ref. 161249.

Maintenance level:

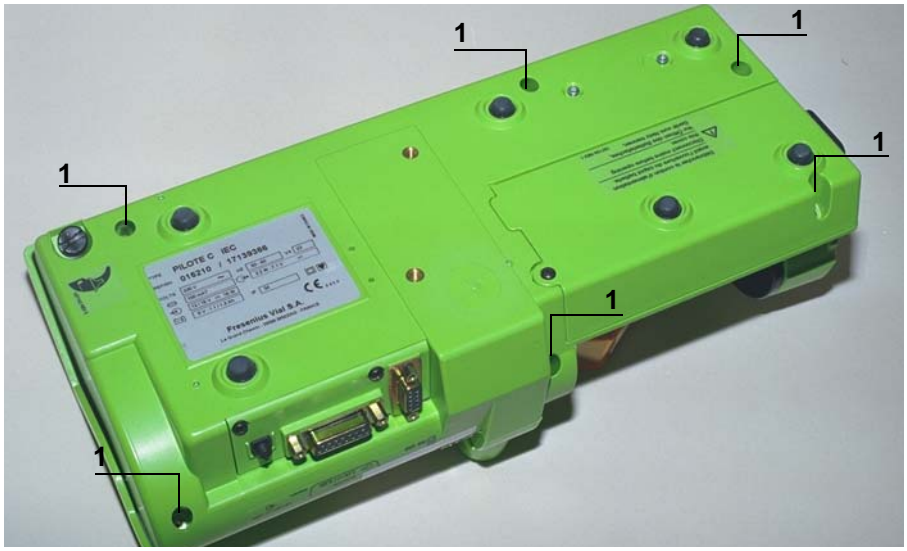
Level 2, specialised technician (see documentation on biomedical training).

Switch replacement procedure:

Access

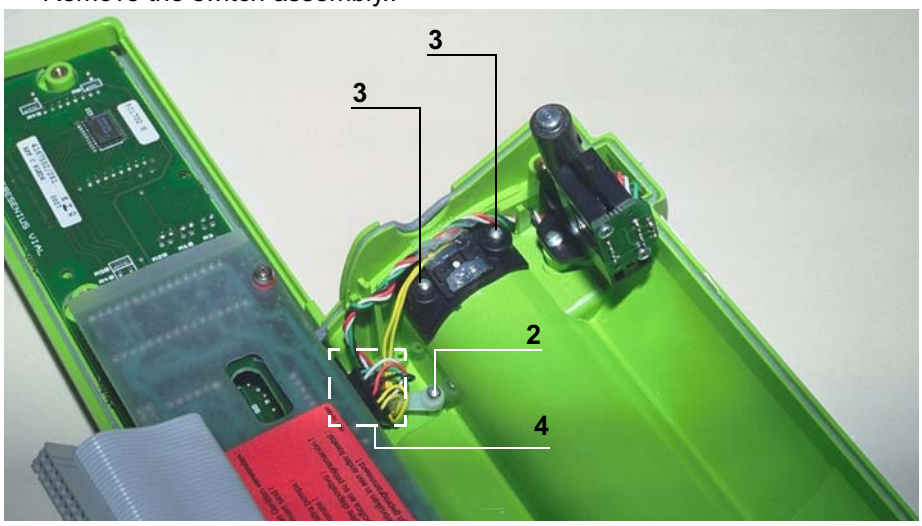
- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case.
- Disconnect the CPU board flat cable.

Hands must not come into contact with the CPU boards.



Dismounting

- Disconnect the connector (ref. 4).
- Unscrew the Phillips head screw (ref. 2) which holds the conductor to the upper case.
- Unscrew the 2 Phillips head screws (ref. 3) which hold the switch support in position.
- Remove the switch assembly..



Welding and unwelding operations are carried out using a soldering iron fitted with a tip in good condition, constantly tapered and clean kept. The temperature of the iron should be between 315°C and 340°C.

- Unweld the sensor wires on the switch
  - Add more weld to facilitate the unwelding process.
  - Heat and pull on the wires one by one
  - Straighten up the 4 mounting lugs and remove the switch.

Reassembly

- Place the new switch on the support.
- Bend the mounting lugs towards the inside in order to lock thel into position.
- Weld the wires of the new switch:
  - Tin-plate the 2 wires to be soldered and the switch support.
  - Place the wires under the bendt lugs.
  - Place the welding iron tip on the welding surface.
  - Place the welding wire on the pin surface of the switch to be welded.
  - Remove the welding wire and then the wilding iron tip.
    - Check that the weling has been carried out correctly. It bshould not form a ball, but should lie against the lengh of the wire.
- Screw the 2 Phillips head screws (ref. 3) which hold the "switch support" assembly in position.

When mounting the "switch support"*, it is important to reduce the torque in the plastic inserts so as to avoid causing damage to these.*

- Connect the conductor to the CPU board.
- Tighten the Phillips head screw holding the conductor (ref. 2).
- Place the 2 drops on the switch contacts in order to insulate these.

Carry out the same procedures in reverse to remount the unit.

When fitting the upper case, ensure the seal is perfectly positioned in its slot after reassembly.

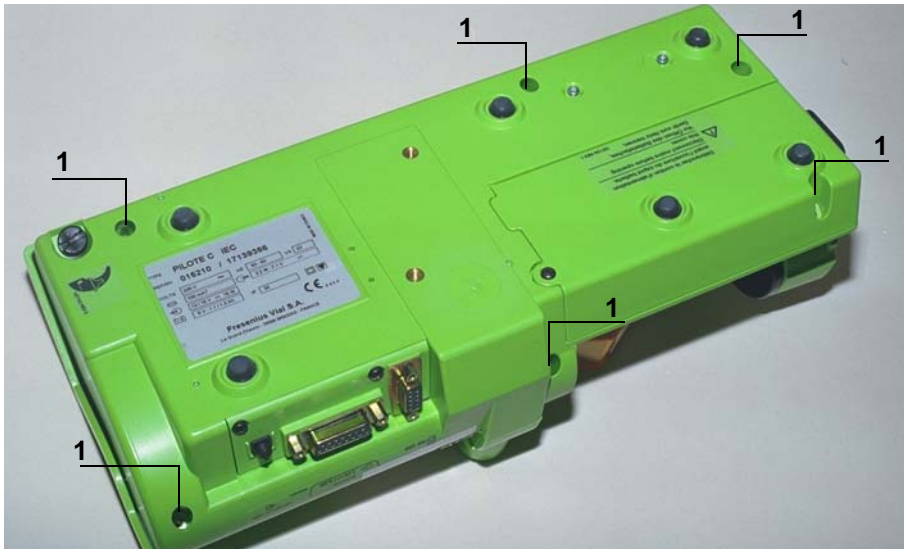
- Perform the regular servicing checks (see "Quality Control Certificate").

Opto replacement procedure:

Access

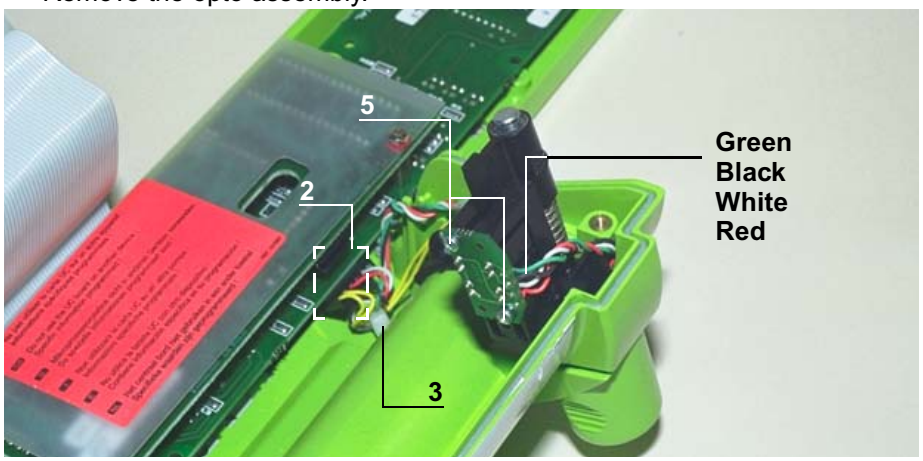
- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case.
- Disconnect the CPU board flat cable.

Hands must not come into contact with the CPU boards.



Dismounting

- Disconnect the connector (ref. 2).
- Unscrew the Phillips head screw (ref. 3) which holds the conductor to the upper case.
- Unscrew the 2 Phillips head screws (ref. 5) which hold the opto PCB in position.
- Remove the opto assembly.



Reassembly

- Place the new opto assembly on the PCB support.
- Screw the 2 Phillips head screws (ref. 5) which hold the "PCB and opto" assembly in position.

When mounting the "PCB and opto"*, it is important to reduce the torque in the plastic inserts so as to avoid causing damage to these.*

- Connect the conductor to the CPU board.
- Tighten the Phillips head screw holding the conductor (ref. 2).

Carry out the same procedures in reverse to remount the unit.

When fitting the upper case, ensure the joint is perfectly positioned in its slot after reassembly.

- Perform the regular servicing checks (see "Quality Control Certificate").

N°4, Procedure: Motor + Opto + Disk

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 antistatic wriststrap.

Maintenance level:

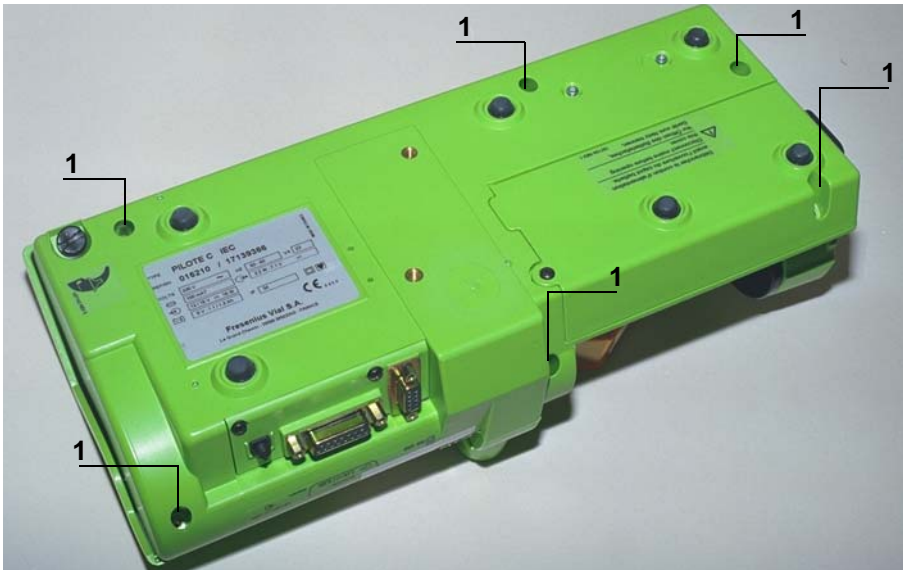
Level 2, specialised technician (see documentation on biomedical training).

Procedure:

Access

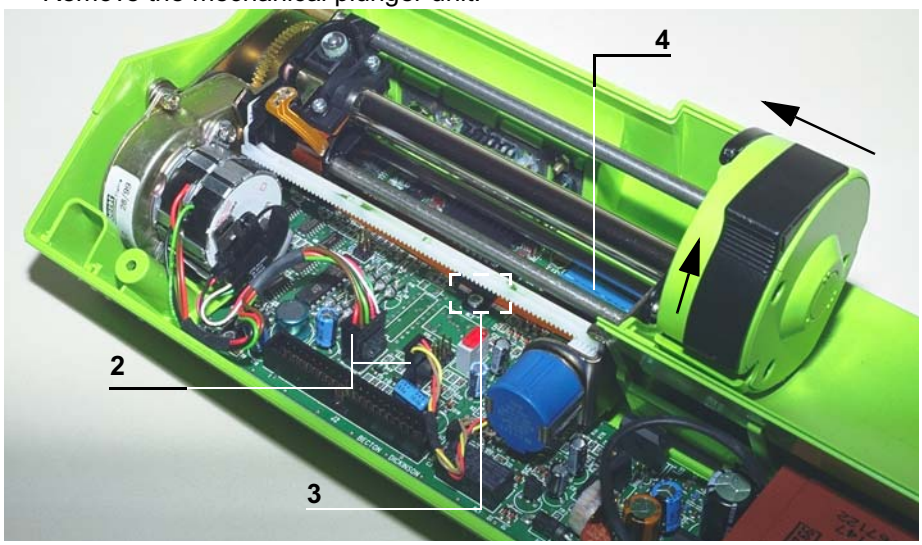
- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case making sure the CPU board flat jumper is not accidentally removed in the process.
- Disconnect the CPU board flat jumper.

Hands must not come into contact with the CPU boards.

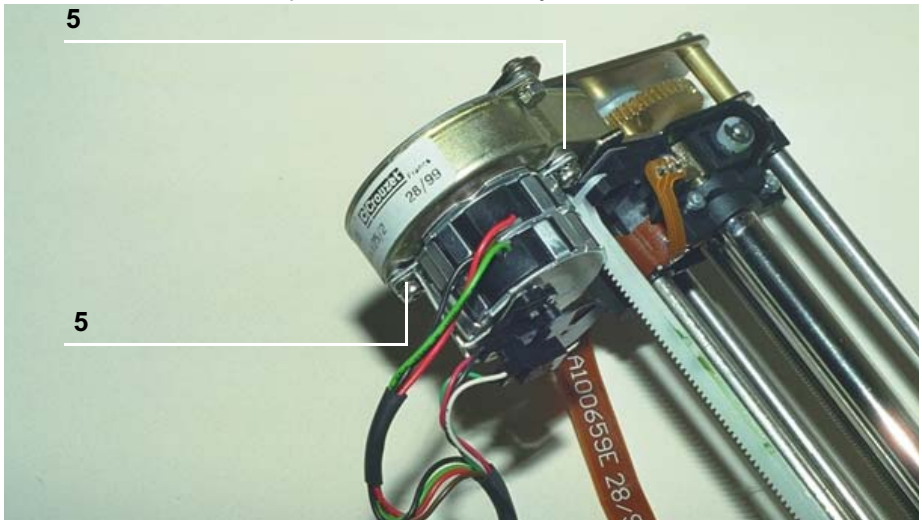


Dismounting

- Press the disengagement lever towards the back of the **Pilot** as far as possible.
- Maintain this position and slide the whole unit to the back left.
- Remove the plunger guide.
- Disconnect the black connectors (ref. 2).
- Unscrew the flat jumper mounting lug (ref. 3) without removing it.
- Remove the mechanical plunger unit from its slot.
- Disconnect the blue connector from the flat jumper (ref. 4).
- Remove the mechanical plunger unit.



- Unscrew the 2 Phillips head screws (ref. 5).
- Remove the motor, opto and disk assembly.



Reassembly

Carry out the same procedures in reverse to remount the unit.

When fitting the upper case, ensure the joint is perfectly positioned in its slot after reassembly.

- Perform the regular servicing checks (see "Quality Control Certificate").

N°5, Procedure: Dynamometer sensor

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 hexagon socket key (2.5).
- 1 soldering iron.
- "RADIEL Sn60Pb RI 1" welding wire (cleaning not required for re-welding) or equivalent.

Maintenance level:

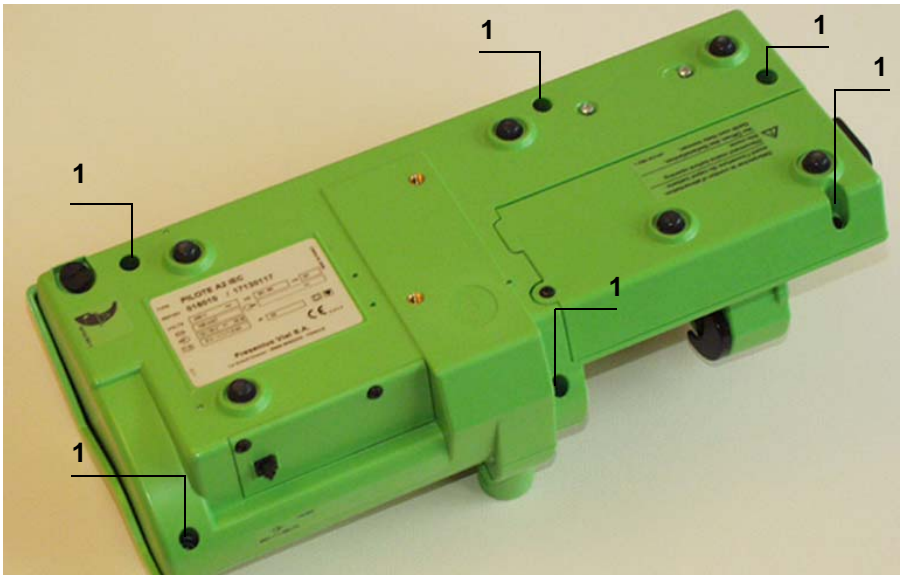
Level 2, specialised technician (see documentation on biomedical training).

Procedure:

Access

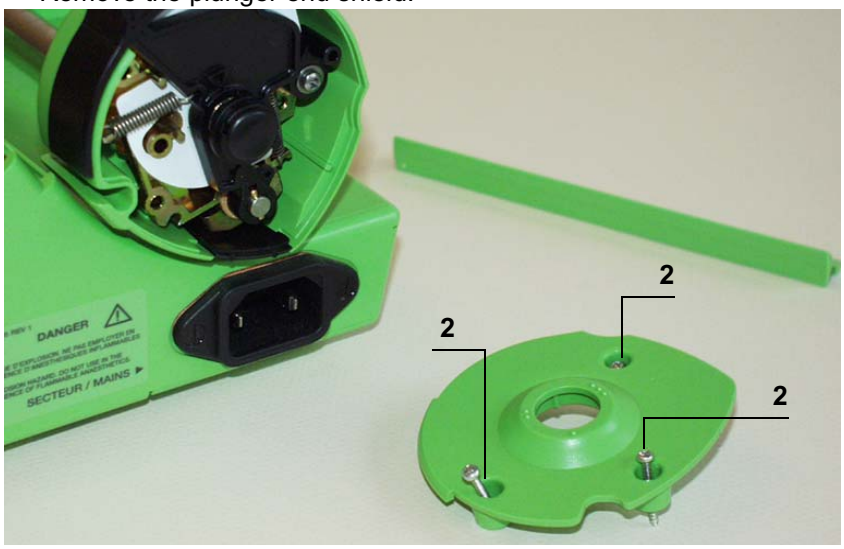
- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case making sure the CPU board flat jumper is not accidentally removed in the process.

Hands must not come into contact with the CPU boards.

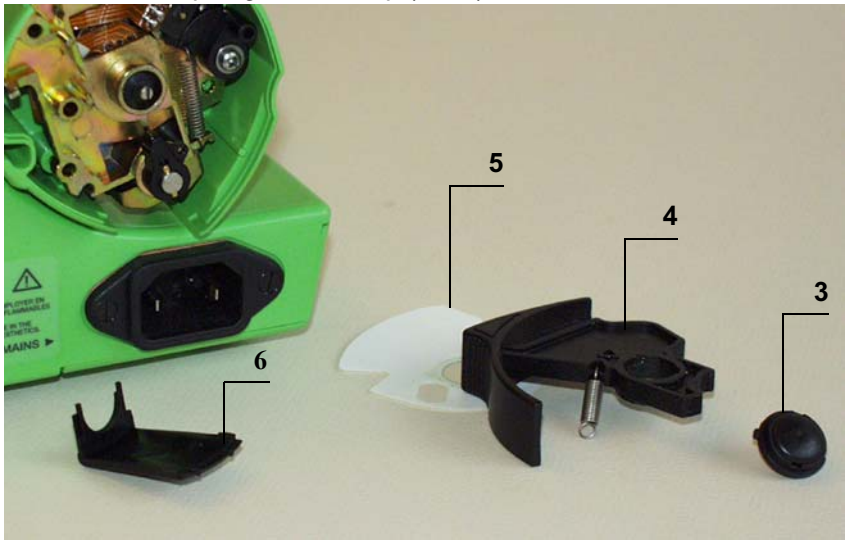


Dismounting

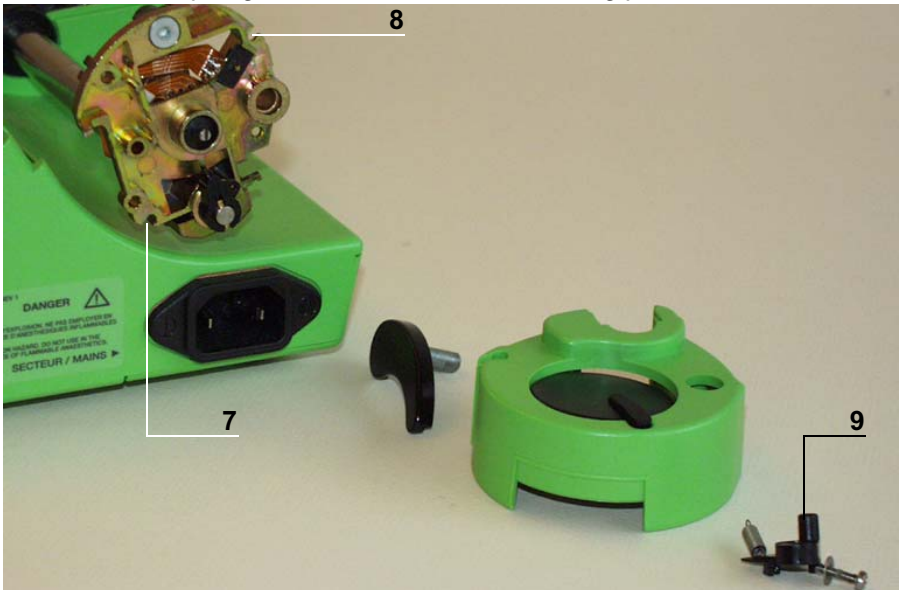
- Press the syringe pump disengagement lever towards the back of the **Pilot** as far as possible.
- Maintain this position and slide the whole unit to the back right.
- Remove the plunger guide.
- Unscrew the 3 Phillips head screws (ref. 2) located at the bottom of the plunger end shield which links this to the plunger cover.
- Remove the plunger end shield.



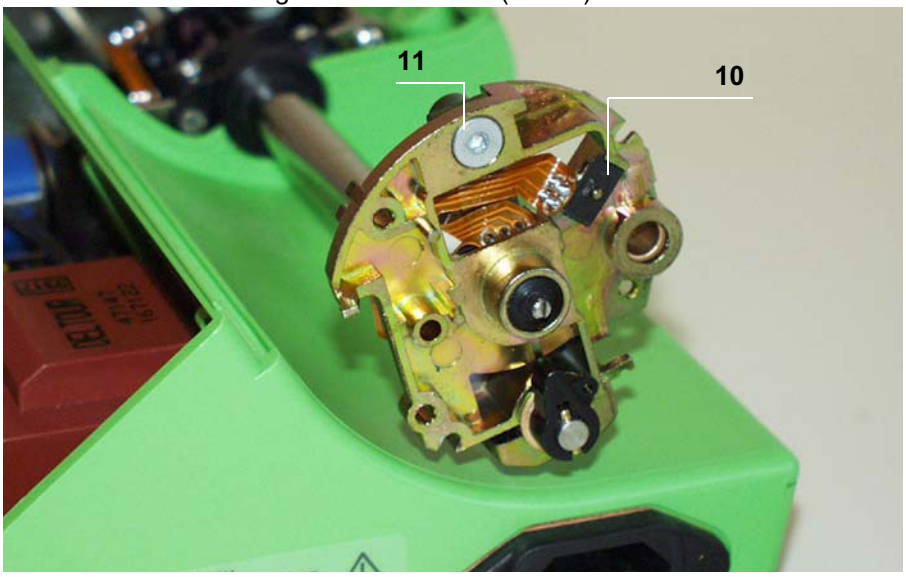
- Remove the backpressure adjustment button (ref. 3).
- Remove the disengagement lever and its spring (ref. 4) as well as the protective plunger film (ref. 5).
- Remove the plunger cover clip (ref. 6).



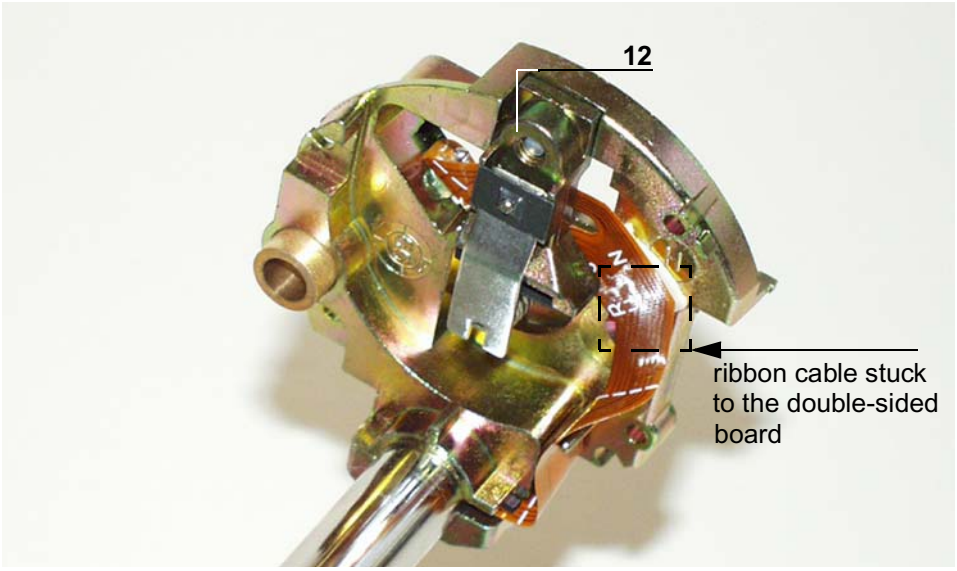
- Unscrew the 2 Phillips head screws (ref. 7 and 8) which link the plunger support to the plunger cover.
- Unscrew and remove the Phillips head screw and the washer (ref. 9) which attach the anti-siphon cam to the anti-siphon arm.
- Remove the cam/arm assembly.
- Remove the plunger cover fitted with the bonding pad.



- Remove the retaining ring that holds the anti-siphon opto in place (ref. 10).
- Unscrew the 6 hexagon socket screws (ref. 11).



- Remove the backpressure micro support/spring leaf (ref. 12).
- Pull off the ribbon cable from the double-sided board



Welding and unwelding operations are carried out using a soldering iron fitted with a tip in good condition, constantly tapered and kept clean. The temperature of the iron should be between 315°C and 340°C.

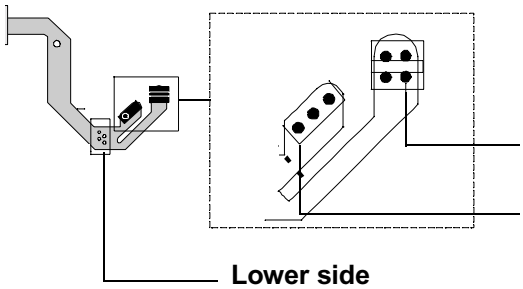
- Unweld the sensor wires on the flex circuit.

When dismounting the force sensor, ensure the welding pellets are not damaged.

- ☐ Add more weld to facilitate the unwelding process.
- ☐ Heat and pull on the wires one by one.

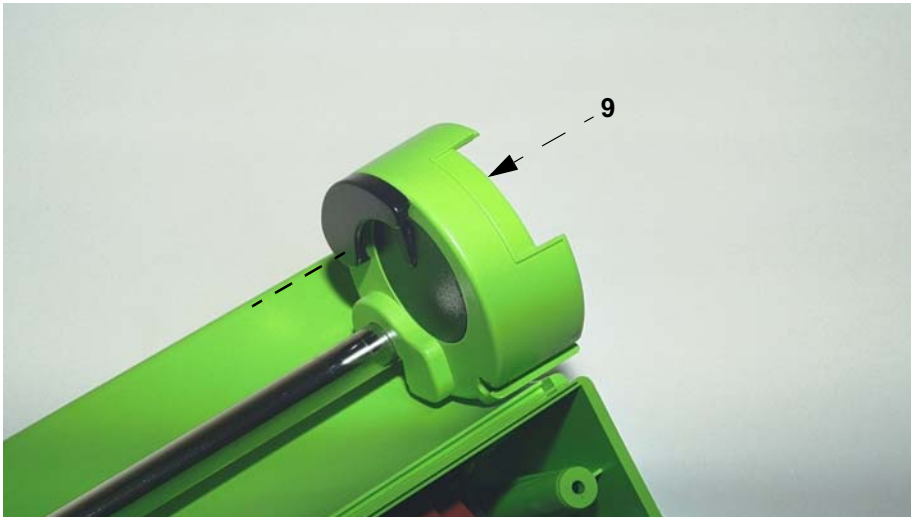
Reassembly

- Weld the ribbon cable to the new pressure switch, ensuring the mounting procedure is carried out in order:
  - Taper the 3 welding points.
  - Weld the 3 points.
  - Check that the welding has been carried out correctly. It should not form a ball, but should lie against the length of the component snubbers.
- Repeat the operation for the anti-siphon opto (4 welding points).
- Stick the bottom side of the ribbon cable to the double-sided board.



Lower side
(connection specific to Pilot C)
stuck to the double-sided board on the plunger support

- Impregnate with weak loctite and screw the 6 hexagon socket screws (ref. 11), which hold the spring leaf/backpressure micro support in position.
- Position the opto and its retaining ring (ref. 10).
- Mount the plunger cover onto the plunger support. Impregnate the screw with weak loctite (rep. 9).
- Position and screw the cam/anti-siphon arm unit using the Phillips head screw and the washer (ref. 9).
- Screw the 2 Phillips head screws (ref. 8 and 7) which link the plunger support to the plunger cover.
- Position the plunger cover clip (ref. 6).



- Cover the plunger with the protective film, mount the disengagement lever, its spring and the adjustment button. Screw the plunger end shield back on (ref. 5, 4 and 3).
- Position the plunger cover and screw it back on (ref. 2).

Carry out the same procedures in reverse to remount the unit.

When fitting the upper case, ensure the joint is perfectly positioned in its slot after reassembly.

Recalibrate the pressure sensor (see "Calibrations") then carry out the regular servicing tests (see "Regular servicing sheet").

N°6, Procedure: Plunger advance control potentiometer

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 flat screwdriver.
- 1 flat key (12).
- 1 potentiometer dismounting tool ref. T300869.

Maintenance level:

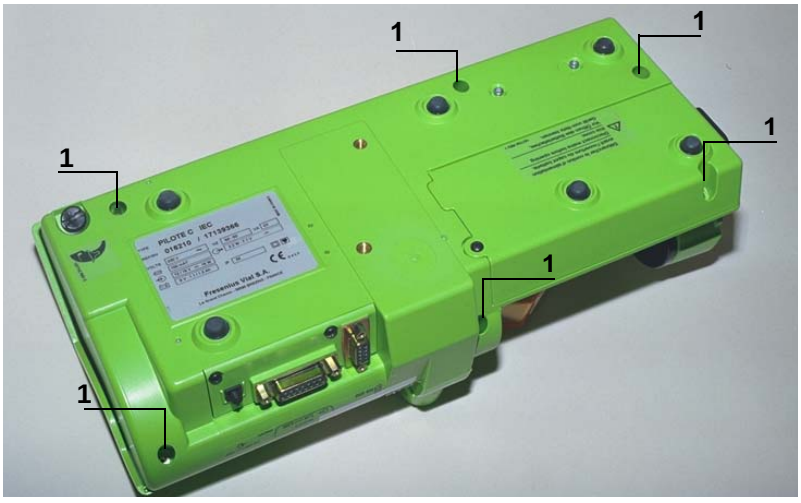
Level 2, specialised technician (see documentation on biomedical training).

Procedure:

Access

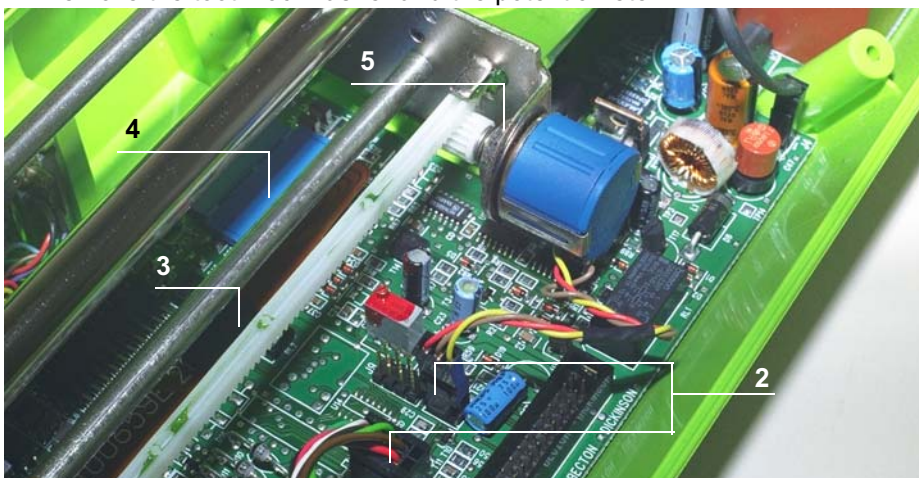
- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower housing case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case.
- Disconnect the CPU board flat cable.

Hands must not come into contact with the CPU boards.



Dismounting

- Press the disengagement lever towards the back of the **Pilot** as far as possible.
- Maintain this position and slide the whole unit to the back left.
- Remove the guide rail.
- Disconnect the black connectors (ref. 2).
- Unscrew the flex circuit bracket (ref. 3) without removing it.
- Remove the mechanical plunger unit from its slot.
- Disconnect the blue connector from the flex circuit (ref. 4).
- Remove the mechanical plunger unit.
- Unscrew the potentiometer lock nut (ref. 5).
- Remove the tooth lockwasher and the potentiometer.



Reassembly

- Dismount the end shield from the reducer frame.
- Mount the potentiometer onto the end shield (screw the nut onto a thread).
- Position the end shield in equipment T 300 869 and lock it into position using the knurled screw.
- Position the potentiometer in the tool and bring it up against the end shield.
- Tighten the potentiometer.
- Extract the end shield from device T 300 869.
- Mount the pinion on the potentiometer (match up the indexing plane).
  - The larger diameter of the pinion must be flattened against the potentiometer.
- With the potentiometer facing you, turn the pinion anticlockwise until it blocks, then turn it ¼ of a turn in the opposite direction.
- Mount the moving mechanical assembly onto the reducer frame.
- Slide the end shield onto the guides and rack.
  - Check the position of the input bearing which must be on the plunger side.
  - Ensure the flex circuit is not damaged when mounting (folding).
- Fix the end shield using the three M3x3 TC screws.
- Fix the input bearing using the two M3x3 TC screws.

When fitting the upper case, ensure the seal is perfectly positioned in its slot after reassembly.

- Recalibrate the position sensor (see "Calibrations") then perform the regular servicing checks (see "Quality Control Certificate").

N°7, Procedure: Plunger cover and/or disengagement lever + anti-siphon arm

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.

Maintenance level:

Level 2, specialised technician (see documentation on biomedical training).

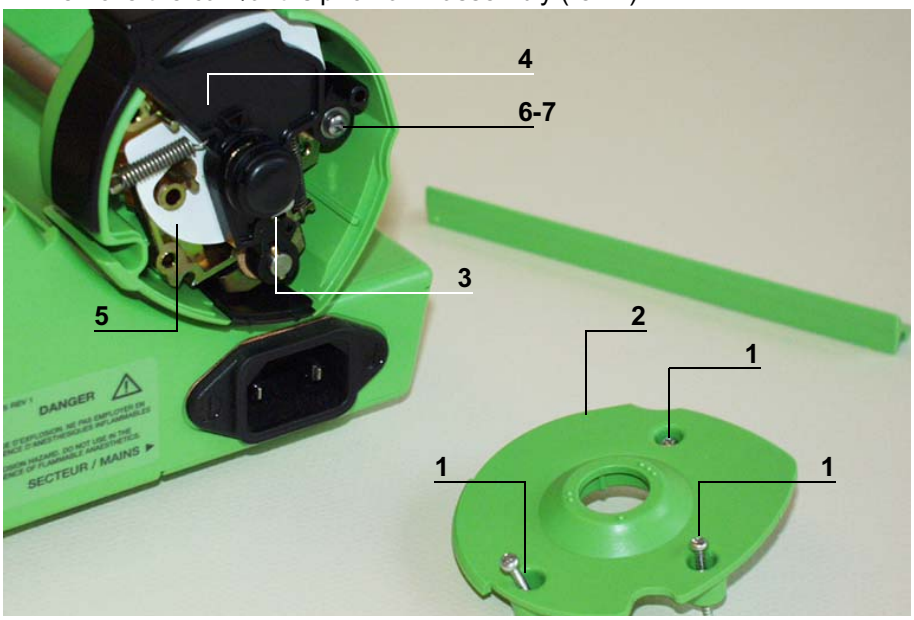
Procedure:

Access

- Press the syringe pump disengagement lever towards the back of the **Pilot** as far as possible.
- Maintain this position and slide the whole unit to the back right.

Dismounting

- Unscrew the 3 Phillips head screws (ref. 1) located at the bottom of the plunger end shield which links this to the plunger cover. Remove the plunger end shield (ref. 2).
- Remove the backpressure adjustment button (ref. 3), then the disengagement lever and its spring (ref. 4) as well as the protective plunger film (ref. 5).
- Unscrew and remove the Phillips head screw and the washer (ref. 6) which attach the anti-siphon cam to the anti-siphon arm.
- Remove the cam/anti-siphon arm assembly (ref. 7).



Reassembly

Carry out the same procedures in reverse to remount the unit.

- Impregnate the screw with weak loctite (ref. 6) before mounting the cam and arm assembly.

- Perform the regular servicing checks (see "Quality Control Certificate").

N°8, Procedure: Power supply board

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 small flat screwdriver
- 1 antistatic wriststrap.

Maintenance level:

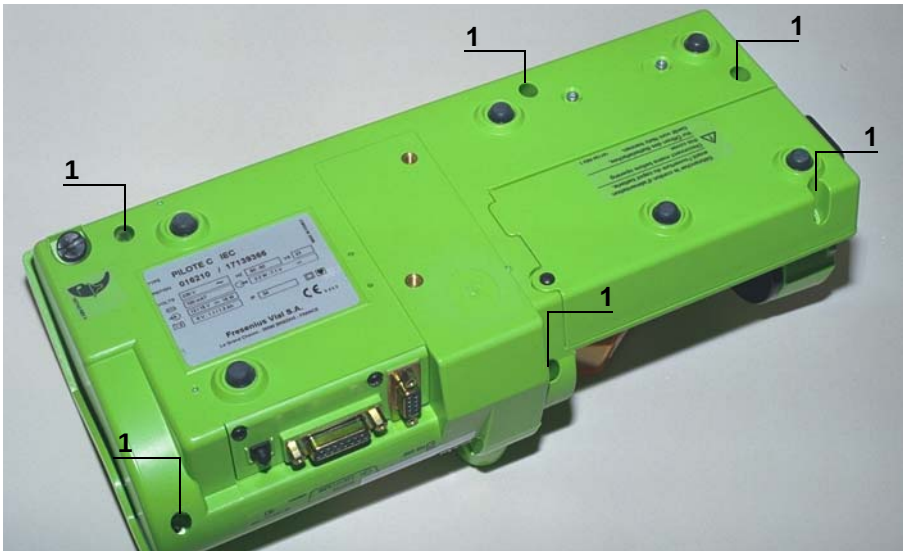
Level 2, specialised technician (see documentation on biomedical training).

Procedure:

Access

- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case.
- Disconnect the CPU board flat cable.

Hands must not come into contact with the CPU boards.

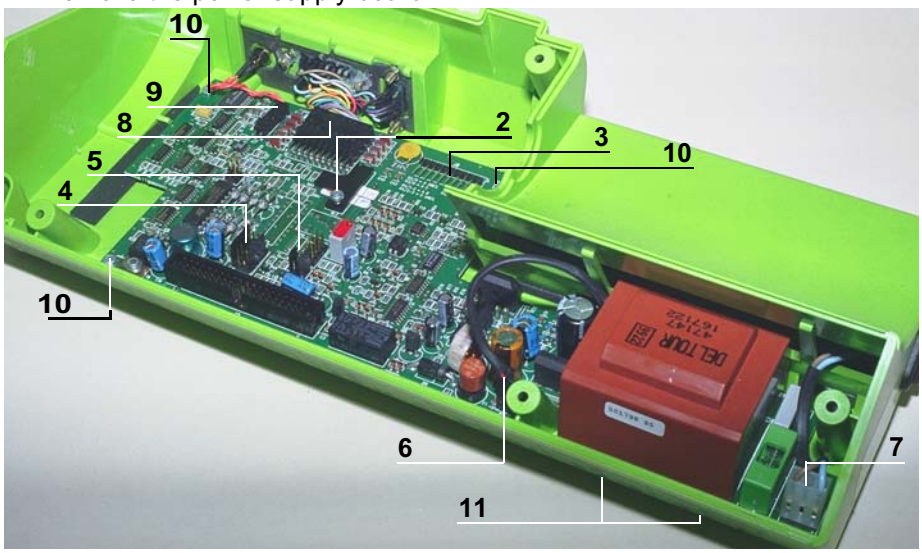


Dismounting

- Press the syringe pump disengagement lever towards the back of the **Pilot** as far as possible.
- Maintain this position and slide the whole unit to the back left.
- Remove the syringe pump guide.
- Disconnect the black connectors (ref 4, ref 5).

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

- Remove the flex circuit bracket (ref 2).
- Remove the mechanical plunger unit from its slot.
- Disconnect the blue connector from the flex circuit (ref. 3).
- Remove the mechanical plunger unit.
- Disconnect the black connectors (ref.6, ref.7, ref.8, ref.9).
- Unscrew the 3 Phillips head screws (ref. 10) located on the power supply board, which link this to the lower case.
- Unscrew the 2 Phillips head screws (ref. 11) located on lower case, which link this to the power supply board.
- Remove the power supply board.



Reassembly

Carry out the same procedures in reverse to remount the unit.

When fitting the upper case, ensure the seal is perfectly positioned in its slot after reassembly.

Recalibrate the force sensor (see "Calibrations") then carry out the regular servicing checks (see "Quality Control Certificate").

N°9, Procedure: Battery door and battery

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.

Maintenance level:

Level 2, specialised technician (see documentation on biomedical training).

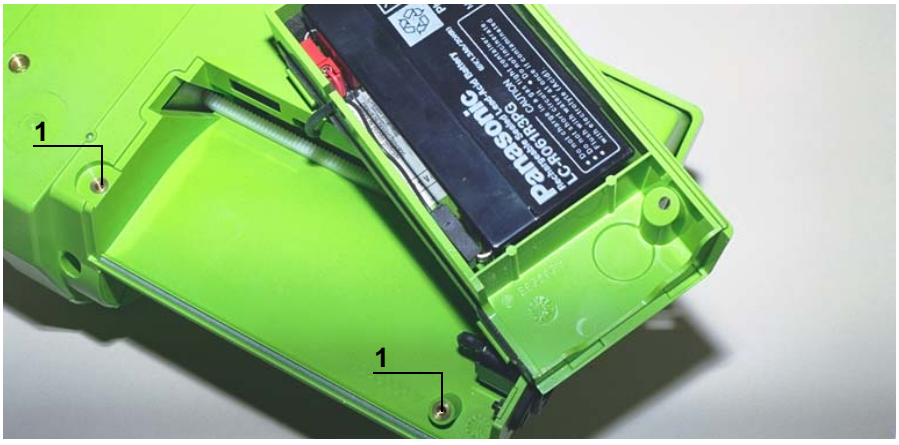
Procedure:

Access

- Turn the **Pilot** over onto the upper case.

Dismounting

- Unscrew the 2 Phillips head screws (ref. 1) which link the battery holder to the lower case.
- Swivel the battery holder and remove the battery.
- Disconnect this.



Reassembly

Carry out the same procedures in reverse to remount the unit.

It is recommended to perform a full loading and unloading cycle to ensure the battery is in working condition.

- Perform the regular servicing checks (see "Quality Control Certificate").

N°10, Procedure: Plug holder wired

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.

Maintenance level:

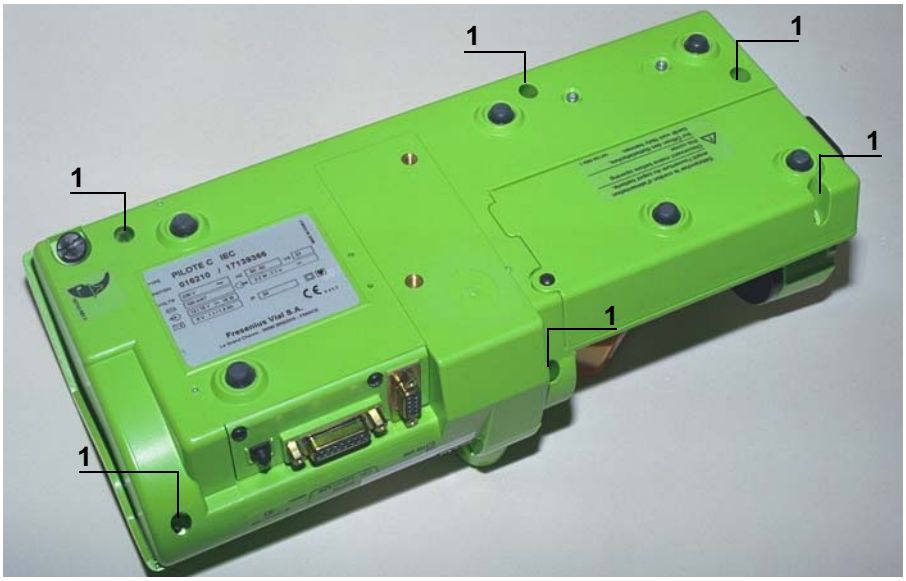
Level 2, specialised technician (see documentation on biomedical training).

Procedure:

Access

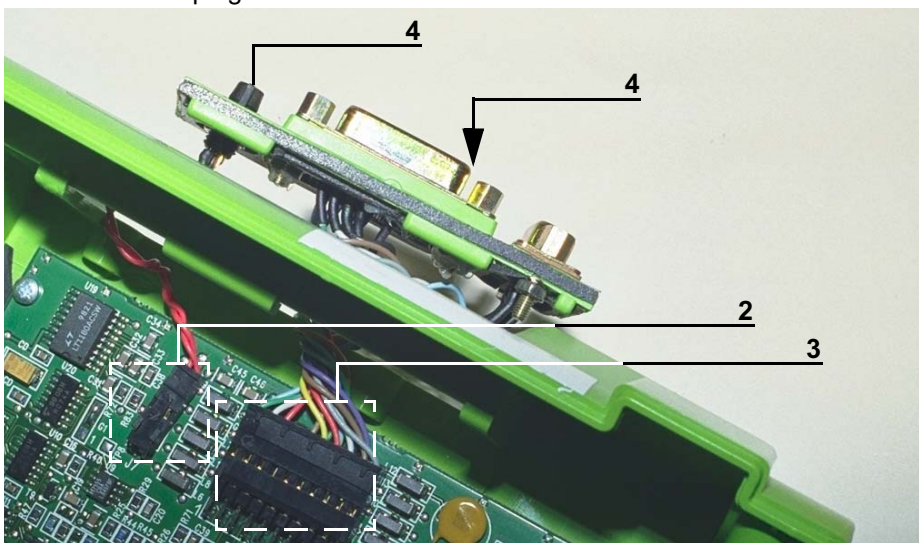
- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case.
- Disconnect the CPU board flat cable.

Hands must not come into contact with the CPU boards.



Dismounting

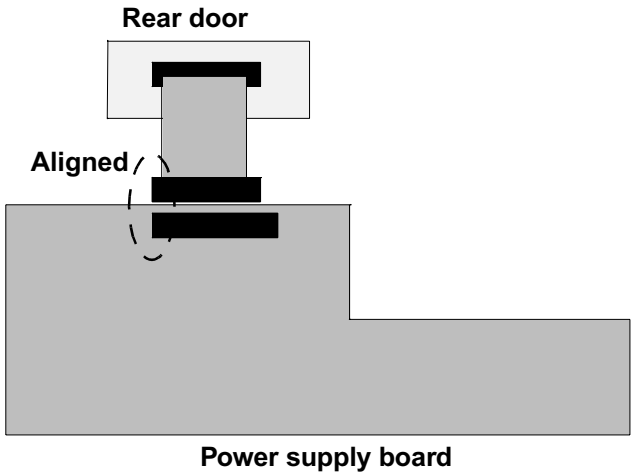
- Disconnect the two black connectors (ref 2 and ref 3).
- Unscrew the 2 Phillips head screws (ref. 4) located on the plug holder wired, which link this to the lower case.
- Remove the plug holder wired.



Reassembly

Carry out the same procedures in reverse to reassemble the parts.

If the number of rear door connector points is different to the number of power supply board points, make the connections as described below.



Perform the regular servicing checks (see "Quality Control Certificate").

N°11, Procedure: Ribbon cable winding kit

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.

Maintenance level:

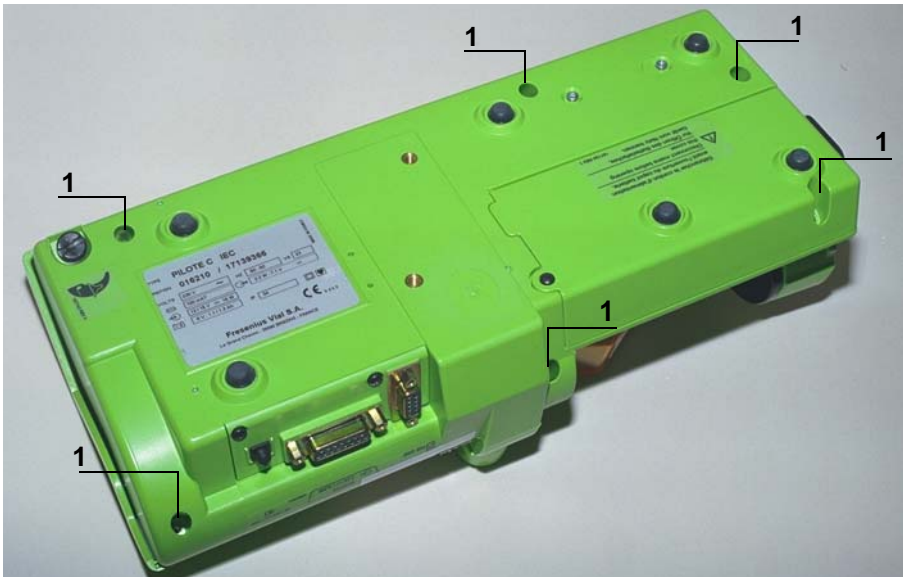
Level 2, specialised technician (see documentation on biomedical training).

Procedure:

Access

- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case making sure the CPU board flat jumper is not accidentally removed in the process.

Hands must not come into contact with the CPU boards.

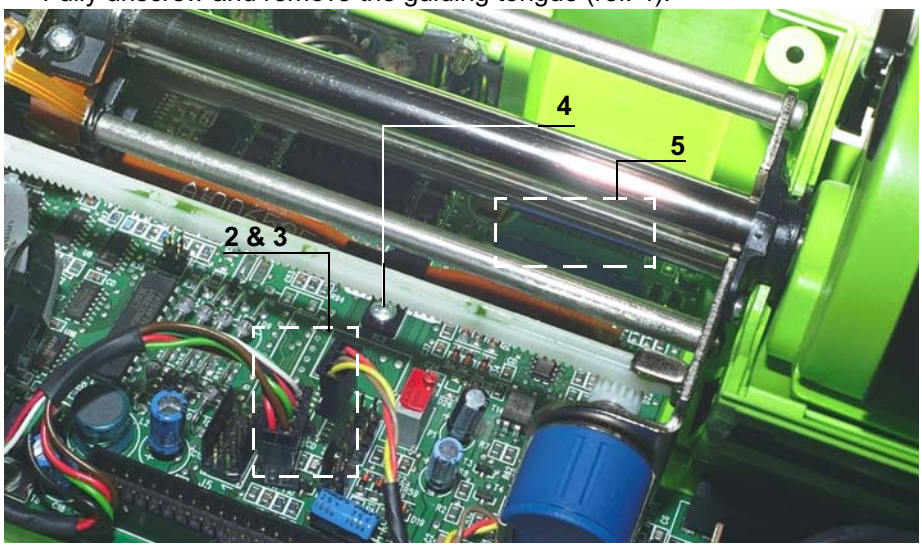


Dismounting

- Press the disengagement lever towards the back of the **Pilot** as far as possible.
- Maintain this position and slide the whole unit to the back left.
- Remove the plunger guide.
- Disconnect the black connectors (ref. 2 and ref. 3).

When electronic components are handled, it is recommended to wear an antistatic wriststrap linked to ground and to work on an antistatic foam mat.

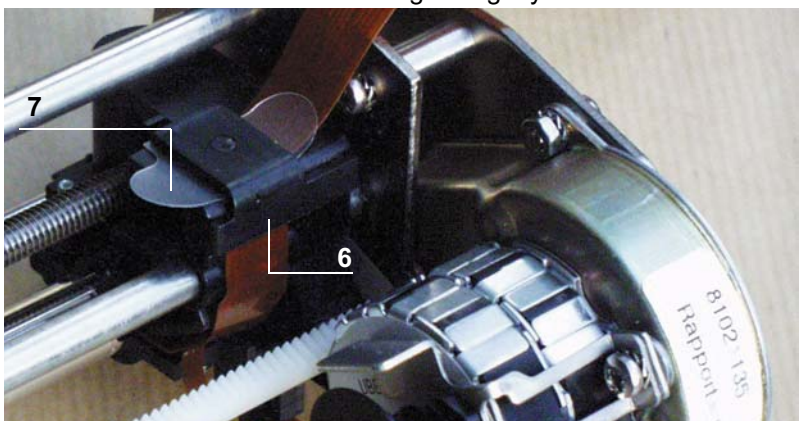
- Unscrew the flat jumper tongue (ref. 4) without removing it.
- Remove the mechanical plunger unit from its slot.
- Disconnect the blue connector (ref. 5) from the flat jumper.
- Remove the mechanical plunger unit.
- Fully unscrew and remove the guiding tongue (ref. 4).



Remounting

Fitting the flexible tongue:

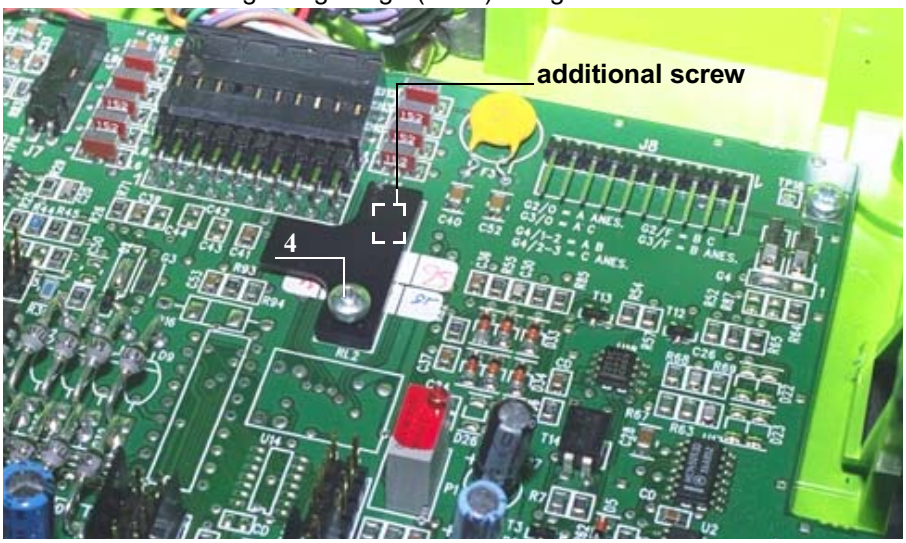
- Remove the clip (ref. 6).
- Stick the flexible tongue (ref. 7) with the adhesive facing the ribbon cable.
- Reposition the clip making sure the ribbon cable and the flexible tongue are centred on the mechanical unit sprocket.
- Lift both ends of the flexible tongue slightly.



Fitting the guiding flange:

There are several types of flange tongues. If you have an older version, replace it with that provided with the kit.

- Connect the blue connector (ref. 5) from the flat jumper.
- Position the whole mechanical plunger unit making sure the ribbon cable is centred under the flange.
- Position the new guiding flange (ref. 4) using the two screws.



- Perform a few movement of the plunger to check the ribbon cable winds up correctly.
- Connect the black connectors (ref. 2 and ref. 3).
- Replace the plunger guide.

Carry out the same procedures in reverse to remount the upper case.

When fitting the upper case, ensure the joint is perfectly positioned in its slot after reassembly.

- Perform the regular servicing checks (see "Quality Control Certificate").

N°12, Procedure: Syringe head detection plunger kit

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 hexagon socket key (2.5).

Maintenance level:

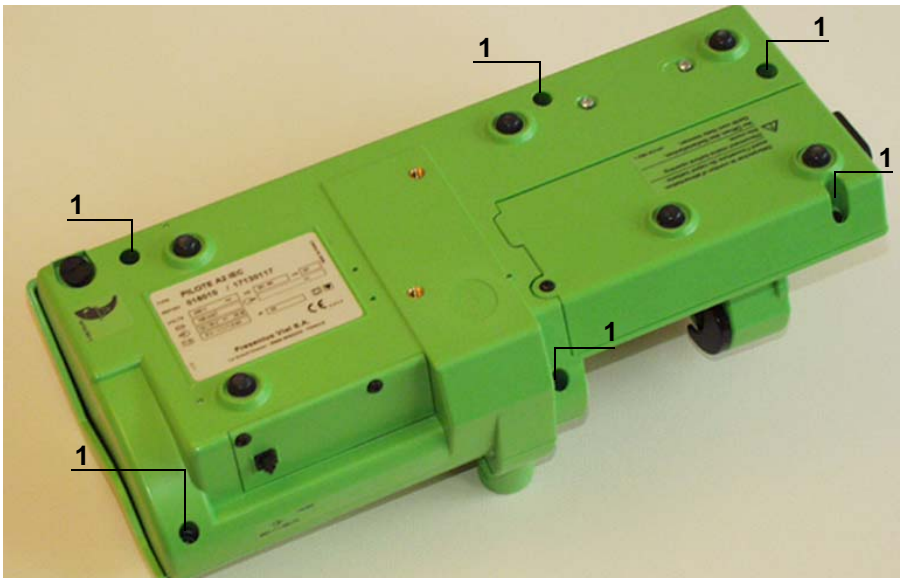
Level 2, specialised technician (see documentation on biomedical training).

Procedure:

Access

- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case making sure the CPU board flat jumper is not accidentally removed in the process.

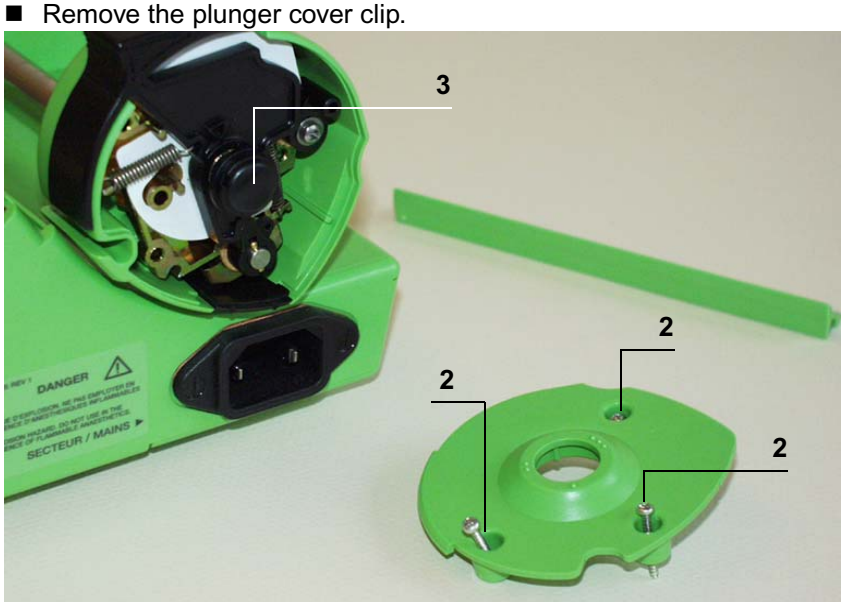
Hands must not come into contact with the CPU boards.



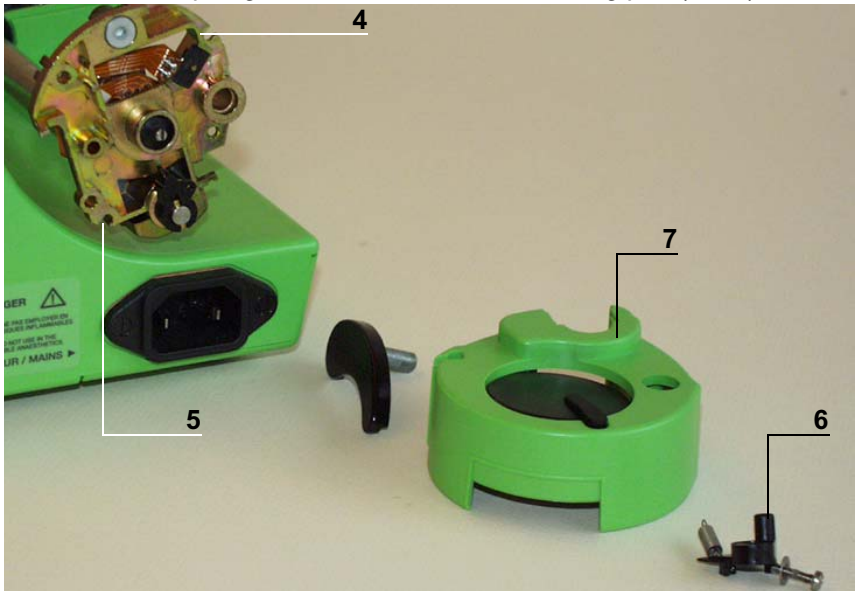
- Press the disengagement lever towards the back of the **Pilot** as far as possible.
- Maintain this position and slide the whole unit to the back right.
- Remove the plunger guide.

Dismounting

- Unscrew the 3 Phillips head screws (ref. 2) located at the bottom of the plunger end shield slots which link this to the plunger cover
- Remove the plunger end shield.
- Remove the backpressure adjustment button (ref. 3)
- Remove the disengagement lever and its spring as well as the protective plunger film.
- Remove the plunger cover clip.

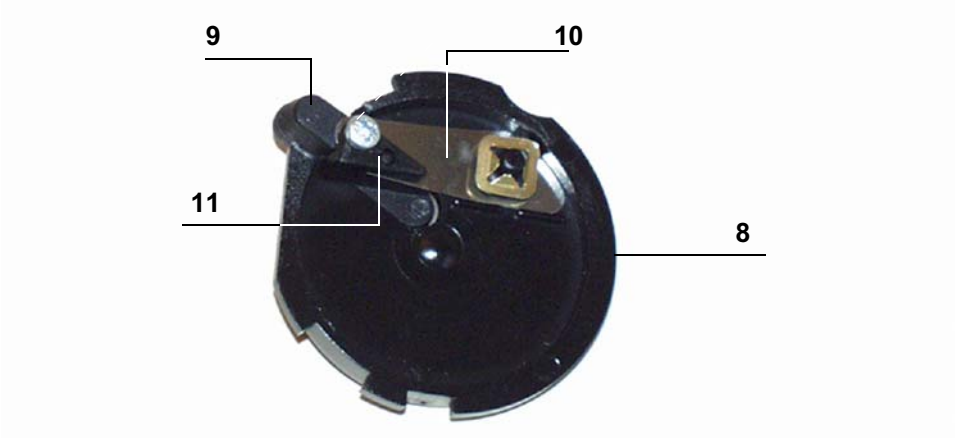


- Unscrew the 2 Phillips head screws (ref. 4 and 5) which link the plunger support to the plunger cover.
- Unscrew and remove the Phillips head screw and the washer (ref. 6) which attach the anti-siphon cam to the anti-siphon arm.
- Remove the cam/arm unit as well as the plunger cover.
- Remove the plunger cover fitted with the bonding pad (ref. 7).



- Unclip the bonding pad assembly from the plunger cover.

■ Remove the Phillips head screw to separate the bonding pad (ref. 8), the removable stop plate (ref. 9), the spring leaf (ref. 10), the stop plate (ref. 11).



Reassembly

■ Tighten the Phillips head screw which holds the stop plate (ref. 11), the spring leaf (ref. 10), the removable stop plate (ref. 9) to the bonding pad (ref. 8).

■ Clip the bonding pad assembly to the plunger cover (ref. 7)

■ Position the plunger cover.

1) Do not forget to replace the anti-siphon cam with the new one supplied with the kit.
2) Weak loctite must be used to mount the new arm and the new anti-siphon arm supplied with the kit.

■ Position and screw the cam/anti-siphon arm unit using the Phillips head screw and the washer (ref 6).

■ Screw the 2 Phillips head screws (ref. 5 and 4) which link the plunger support to the plunger cover.

■ Position the plunger cover clip.

■ Cover the plunger with the protective film, and mount the disengagement lever and its spring, and screw the plunger end shield back on.

Carry out the same procedures in reverse to remount the unit.

When fitting the upper case, ensure the joint is perfectly positioned in its slot after reassembly.

■ Perform the regular servicing checks (see "Quality Control Certificate").

N°13, Procedure: Centering ring kit

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 cutter.
- GEB type 100% silicone grease.

Maintenance level:

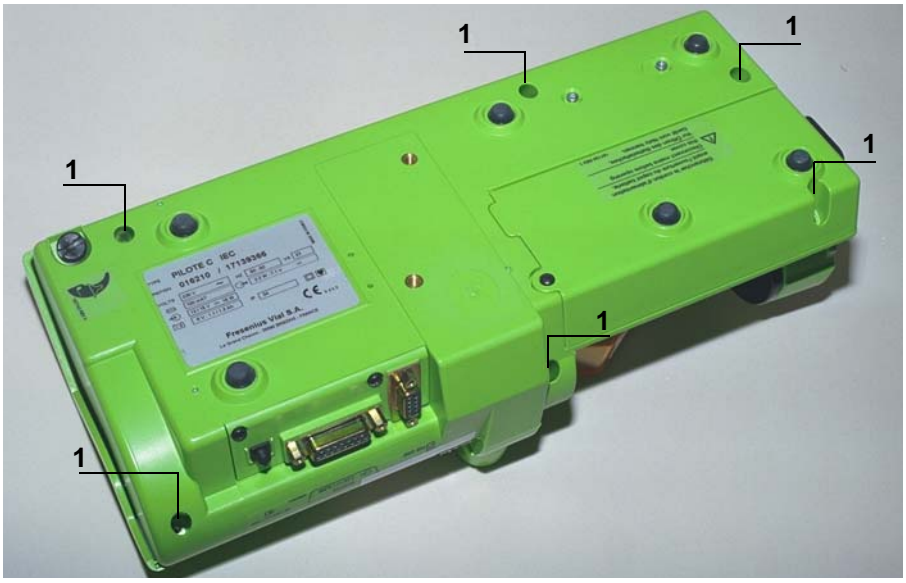
Level 2, specialised technician (see documentation on biomedical training).

Procedure:

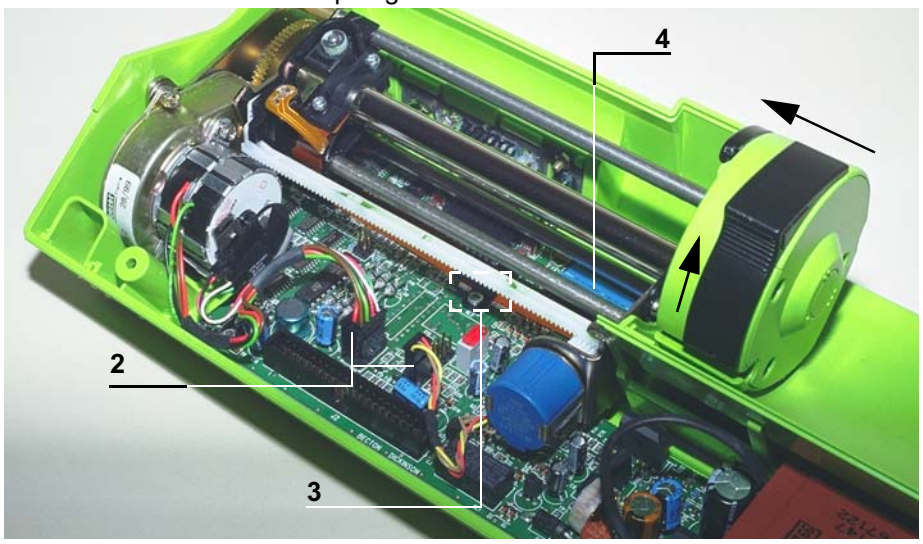
Access

- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case making sure the CPU board flat cable is not accidentally removed in the process.

Hands must not come into contact with the CPU boards.



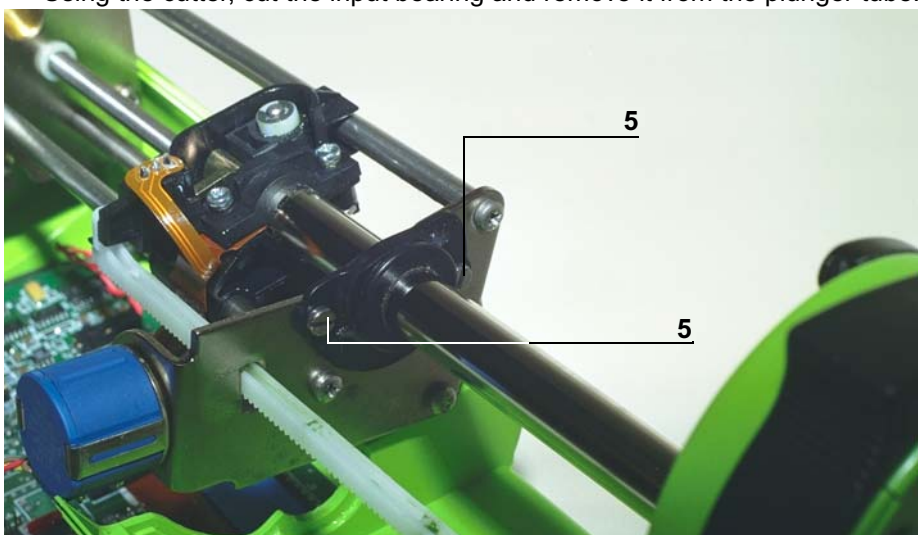
- Press the disengagement lever towards the back of the **Pilot** as far as possible.
- Maintain this position and slide the whole unit to the back left.
- Remove the rail guide.
- Disconnect the black connectors (ref. 2).
- Unscrew the flex circuit bracket (ref. 3) without removing it.
- Remove the mechanical plunger unit from its slot.
- Disconnect the blue connector from the flex circuit (ref. 4).
- Remove the mechanical plunger unit.



- Press the disengagement lever towards the back of the **Pilot** as far as possible.
- Maintain this position and slide the whole unit to the back right.

Dismounting

- Unscrew the 2 slotted head screws (ref. 5) which link the centering ring to the mechanical end shield.
- Using the cutter, cut the input bearing and remove it from the plunger tube.



Remounting

- Mount the new centering ring onto the plunger tube by twisting it.
- Laying it flat on a table, cut the O-ring using a cutter.
- Place the O-ring around the tube.
- Fit the O-ring into the centering ring slot (horizontal cut, so as to avoid lining it up with the centering ring cut).
- Mount the stainless steel slotted plate onto the pin, by twisting it.
- Place the silicone grease cord onto the plate around the passage of the tube.
- Place the plate on the centering ring.
- Position the whole assembly against the mechanical end shield and screw it on using the two slotted screws (ref. 5).
- Check the plunger slides correctly.

It should slide uniformly across the entire centering ring and slight friction is due to the O-ring scraping against the tube.

- Perform the regular servicing checks (see "Quality Control Certificate").

N°14, Procedure: Flex circuit and tube kit

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 antistatic wriststrap.

Maintenance level:

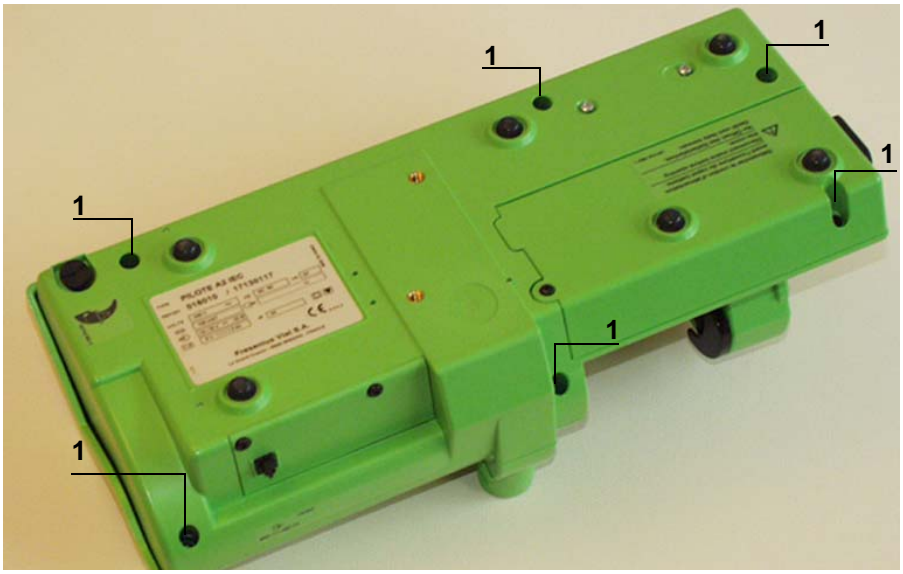
Level 2, specialised technician (see documentation on biomedical training).

Procedure:

Access

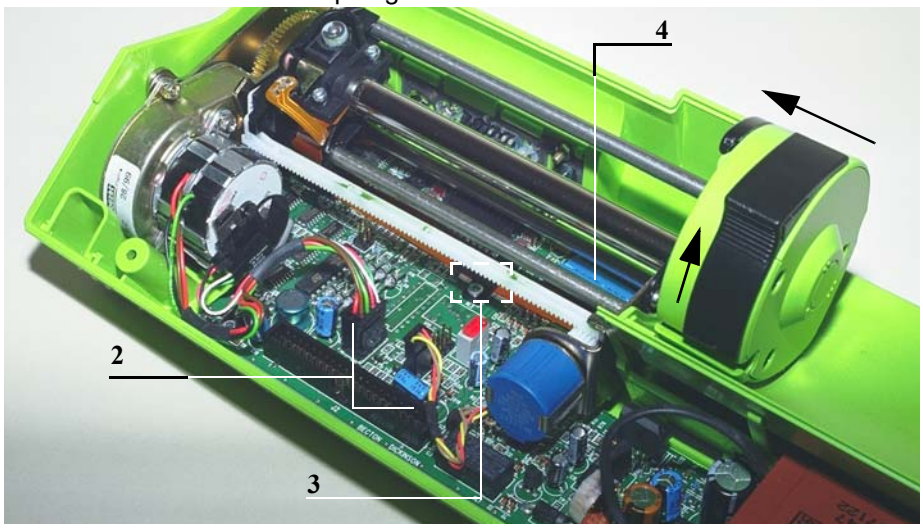
- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case making sure the CPU board flat jumper is not accidentally removed in the process.
- Disconnect the CPU board flat jumper.

Hands must not come into contact with the CPU boards.



Dismounting

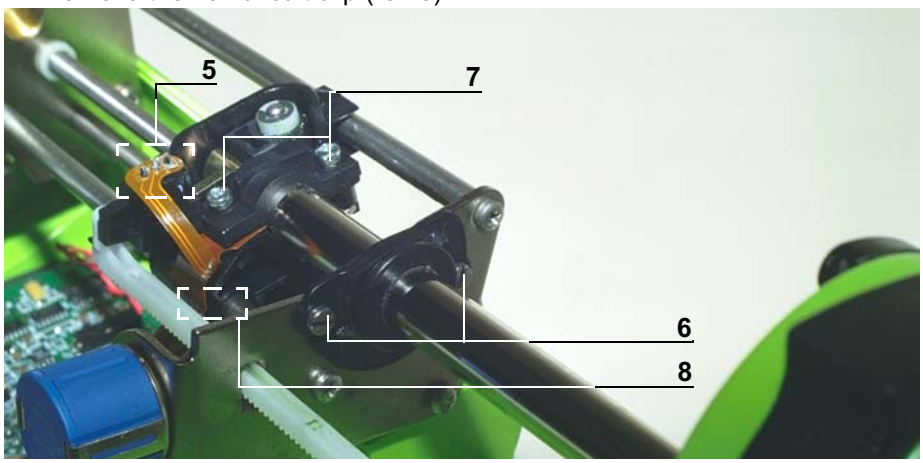
- Press the disengagement lever towards the back of the **Pilot** as far as possible.
- Maintain this position and slide the whole unit to the back left.
- Remove the plunger guide.
- Disconnect the black connectors (ref. 2).
- Unscrew the flat jumper mounting lug (ref. 3) without removing it.
- Remove the mechanical plunger unit from its slot.
- Disconnect the blue connector from the flat jumper (ref. 4).
- Remove the mechanical plunger unit.



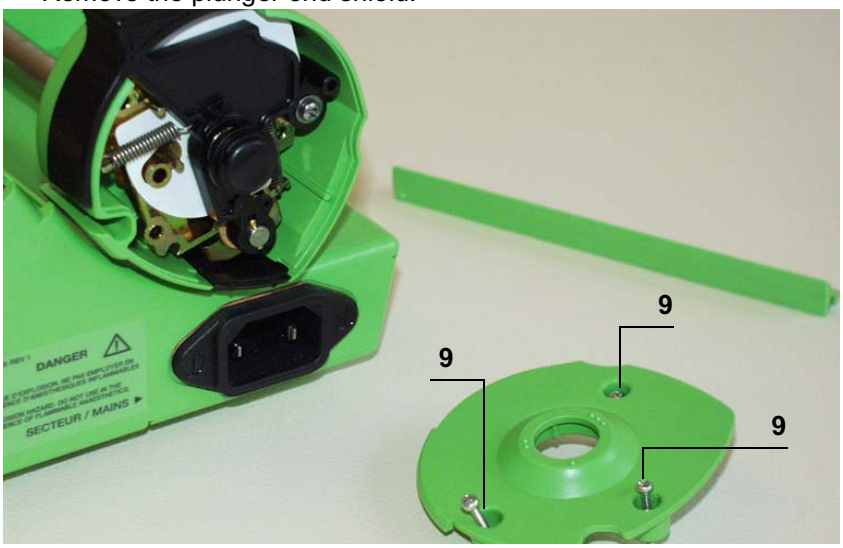
- Press the syringe pump disengagement lever towards the back of the **Pilot** as far as possible.
- Maintain this position and slide the whole unit to the back right.

Welding and unwelding operations are carried out using a soldering iron fitted with a tip in good condition, constantly tapered and kept clean. The temperature of the iron should be between 315°C and 340°C.

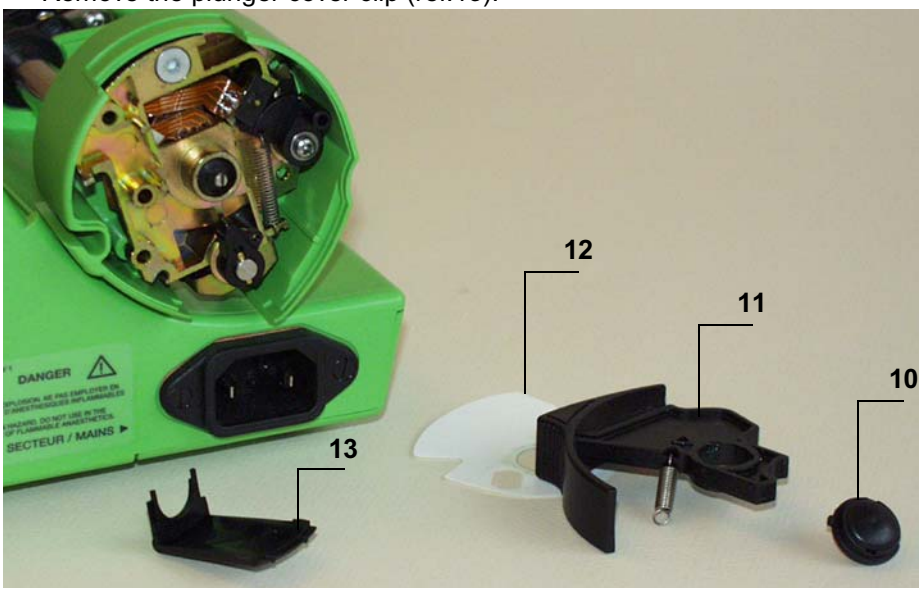
- Unweld the flex circuit (ref. 5) ensuring the disengagement switch is not damaged in the process.
- Unscrew the 2 slotted head screws (ref. 6) which link the centering ring to the mechanical end shield.
- Unscrew the 2 Phillips head screws (ref. 7) which link the centering ring to the mechanical end shield.
- Remove the flex circuit clip (ref. 8).



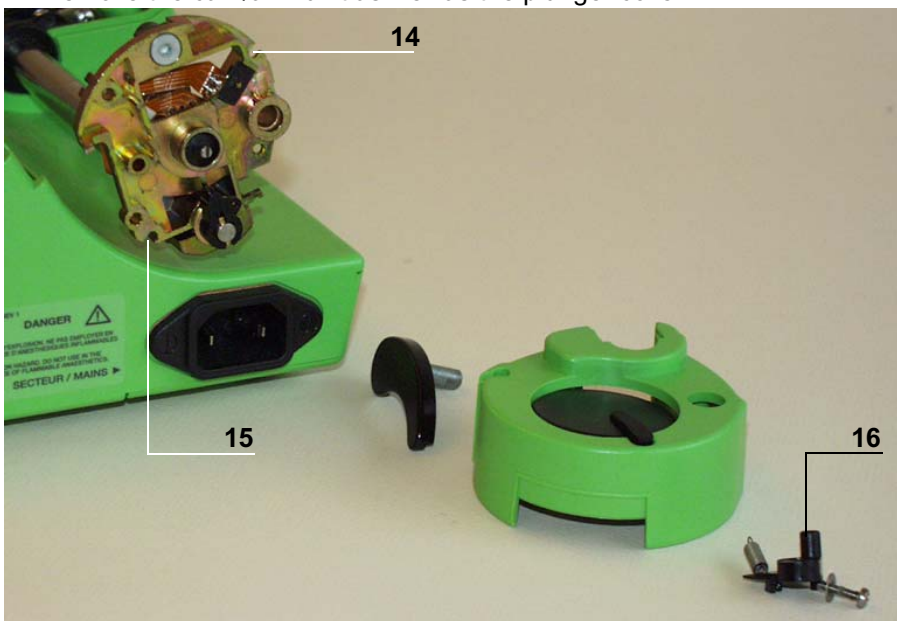
- Remove the plunger guide.
- Unscrew the 3 Phillips head screws (ref. 9) located at the bottom of the plunger end shield which links this to the plunger cover.
- Remove the plunger end shield.



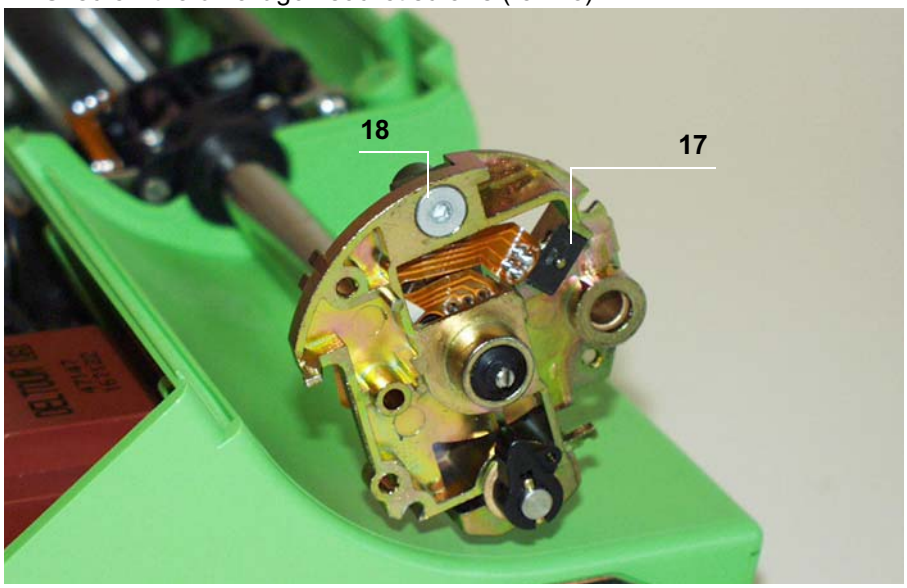
- Remove the backpressure adjustment button (ref. 10).
- Remove the disengagement lever and its spring (ref. 11) as well as the protective plunger film (ref. 12).
- Remove the plunger cover clip (ref.13).



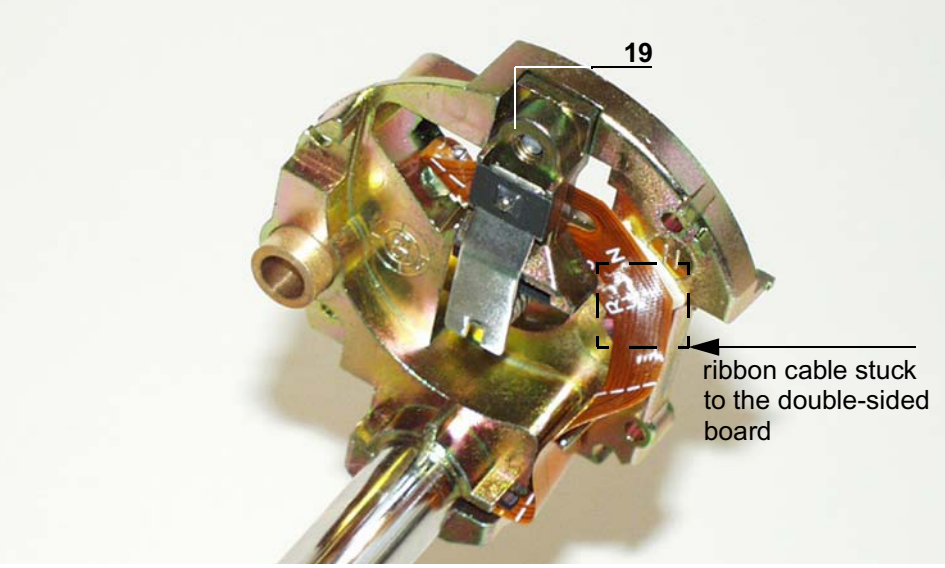
- Unscrew the 2 Phillips head screws (ref. 14 and 15) which link the plunger support to the plunger cover.
- Unscrew and remove the Phillips head screw and the washer (ref. 16) which attach the anti-siphon cam to the anti-siphon arm.
- Remove the cam/arm unit as well as the plunger cover.



- Remove the retaining ring that holds the anti-siphon opto in place (ref. 17).
- Unscrew the 6 hexagon socket screws (ref. 18).



- Remove the backpressure micro support/spring leaf (ref. 19).
- Pull off the ribbon cable from the double-sided board



Welding and unwelding operations are carried out using a soldering iron fitted with a tip in good condition, constantly tapered and kept clean. The temperature of the iron should be between 315°C and 340°C.

- Unweld the sensor wires:

When dismounting the force sensor, ensure the welding blocks are not damaged and the square is not removed in the process.

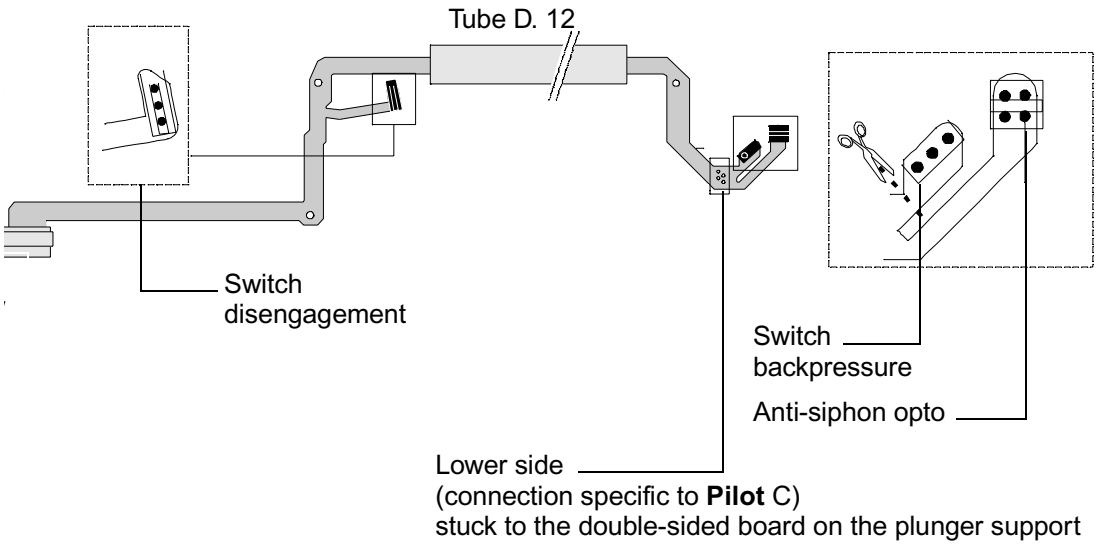
- ☐ Add more weld to facilitate the unwelding process.
- ☐ Heat and pull on the wires one by one.

- Remove the flex circuit and tube kit from the plunger support.

Reassembly

- Remove the sticky tape holding the flex circuit to the tube.
- Mount the new flex circuit onto the plunger support.
- Weld the ribbon cable to the new pressure switch, ensuring the mounting procedure is carried out in order:
  - Taper the 3 welding points.
  - Weld the 3 points.
  - Check that the welding has been carried out correctly. It should not form a ball, but should lie against the length of the component snubbers.

- Repeat the operation for the anti-siphon opto (4 welding points).
- Stick the bottom side of the ribbon cable to the double-sided board.
- Repeat the operation for the disengagement switch. (3 welding points)



Carry out the same procedures in reverse to remount the unit.

Do not forget to impregnate the cam/arm clamping screw (rep. 16) with weak loctite.

When fitting the upper case, ensure the joint is perfectly positioned in its slot after reassembly.

- Recalibrate the force sensor (see "Calibrations") then perform the regular servicing checks (see "Quality Control Certificate").

N°15, Procedure: Upper and lower cases

Safety:

For safety reasons, the technician should not carry out any maintenance when the device is connected to the 230 V mains supply voltage.

Disconnect the mains power supply cable.

Equipment required:

- 1 Posidriv Z1 screwdriver.
- 1 antistatic wriststrap.
- 1 soldering iron.
- "RADIEL Sn60Pb RI 1" welding wire (cleaning not required for rewelding) or equivalent.

Maintenance level:

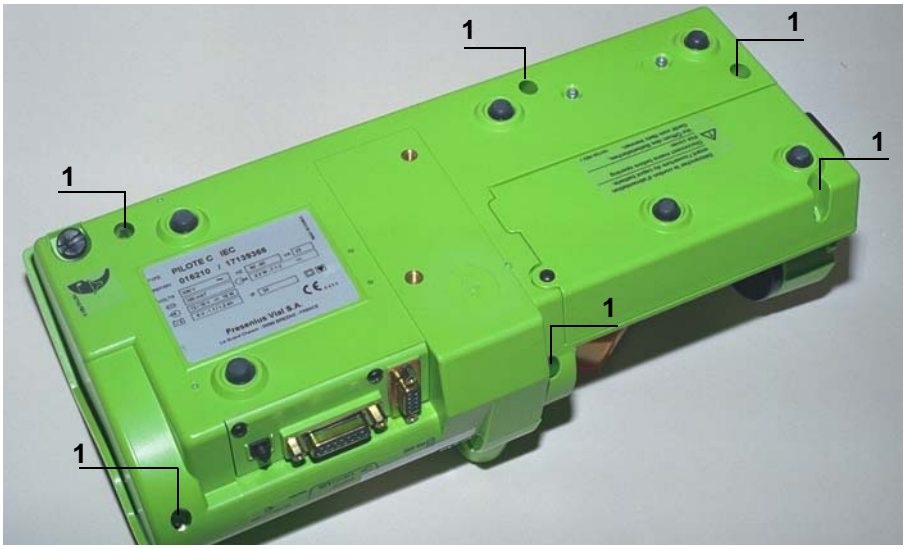
Level 2, specialised technician (see documentation on biomedical training).

Procedure:

Access

- Turn the **Pilot** over onto the upper case.
- Unscrew the 6 Phillips head screws (ref. 1) located at the bottom of the lower case, which link this to the upper case.
- Keep the **Pilot** assembled and turn it over onto the lower case.
- Remove the upper case making sure the CPU board flat jumper is not accidentally removed in the process.
- Disconnect the CPU board flat jumper.

Hands must not come into contact with the CPU boards.



Dismounting the upper cover

- Dismount the central unit and display boards (see corresponding sheet).
- Dismount the syringe clamp (see corresponding sheet).
- Dismount the syringe detection system (see corresponding sheet).

Remounting the upper cover

- Remount the syringe detection system (see corresponding sheet).
- Remount the syringe clamp (see corresponding sheet).
- Remount the central unit and display boards (see corresponding sheet).

  □ If the original lower case is fitted with a removable buzzer bell, you can use your “CPU and display board” kit without having to adapt it.
  □ If the original lower case has a cylindrical guide for accommodating the buzzer, the buzzer from the “CPU and display board” kit must be replaced with the buzzer supplied with the spare parts as the latter is fitted with snubbers and a separate foam joint.
  Follow the mounting diagram shown below to carry out this adaptation procedure.

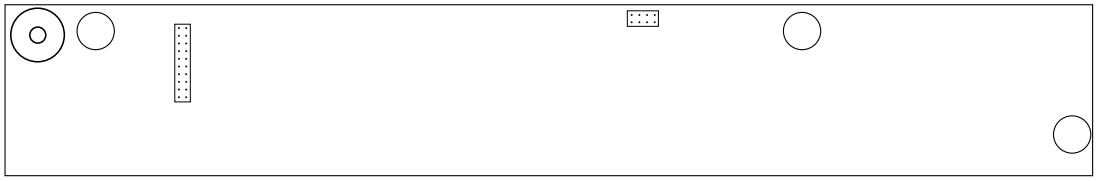
Welding and unwelding operations are carried out using a soldering iron fitted with a tip in good condition, constantly tapered and kept clean. The temperature of the iron should be between 315°C and 340°C.

□ Unweld the snubbers from the buzzer:
- add more weld to facilitate the unwelding process.
- Heat and pull on the buzzer pins one by one.

Clean the buzzer slot surfaces using a cloth soaked in rubbing alcohol.

□ Weld the snubbers of the new buzzer:

Buzzer with snubbers



Display board

- taper the 2 buzzer pins to be welded.
- place the buzzer onto the board following the mounting diagram.
- weld to buzzer onto the board.
- check that the welding has been carried out correctly. It should not form a ball, but should lie against the length of the wire.

Continue with the remounting procedure, referring to the “central unit and display board” sheet.

- Perform the regular servicing checks (see "Quality Control Certificate").

Dismounting the lower cover

- Dismount the power supply board (see corresponding sheet).
- Dismount the battery holder (see corresponding sheet).
- Dismount the rear plug support (see corresponding sheet).

Remounting the lower cover

Carry out the remounting procedure in reverse.

- Perform the regular servicing checks (see "Quality Control Certificate").

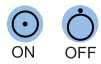
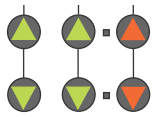
7 Calibration

7.1 Calibration procedure

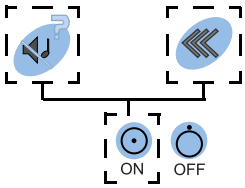
The calibration menu is reserved for authorised personnel only, its access is protected by a secret code.

7.1.1 Calibration access

Keyboard description.

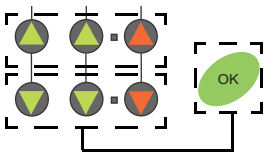
Key	Function
	**ON**, is used to switch the machine ON. **OFF**, is used to switch the machine off when pressed for over three seconds.
	SILENCE ALARM, is used to access the calibration mode.
	CONFIRM, is used to validate a choice.
	BOLUS, is used to access the calibration mode.
	The select keys allow to scroll the figures and letters on the LCD screen, on the units, tens, tenths segments etc.

Activate calibration

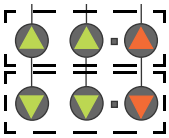


- Press the "SILENCE ALARM" and "BOLUS" keys simultaneously.
- Maintain this position while pressing "ON".
- When EtA. is displayed, release the “SILENCE ALARM” and “PRIME/BOLUS” keys, then validate within three seconds by pressing the “CONFIRM" key.

- 000.0 : enter the calibration mode access code using the select keys, and validate.



- The device initiates the EtA.4 calibration by default
- Scroll the different display unit calibration states using the select keys.
  - EtA.4 : calibration of the 3 battery voltage levels.
  - EtA.6 : calibration of the position sensor.



7.1.2 CtA.4 Calibration of the 3 battery voltage levels.

This menu enables the user to store the three Bat1, Bat2 and Bat3 battery voltage values in an EEPROM.

■ CtA.4, press "CONFIRM".

OK

- □ bAt.1: supply the device with 6.3 V± 0,05 using a stabilised power supply.
  - ♦ Press "CONFIRM".
    The voltage is read and stored in the EEPROM.
- □ Press "CONFIRM".
- □ bAt.2: supply the device with 5.9 V± 0,05 using a stabilised power supply.
  - ♦ Press "CONFIRM".
    The voltage is read and stored in the EEPROM.
- □ Press "CONFIRM".
- □ bAt.3: supply the device with 5,7 V± 0,05 using a stabilised power supply.
  - ♦ Press "CONFIRM".
    The voltage is read and stored in the EEPROM.

□ By validating once again, it is possible to select another calibration.

7.1.3 CtA.6 Calibration of the position sensor.

This menu enables users to store both high and low displacement limit values in the EEPROM.

■ CtA.6, press "CONFIRM".

OK

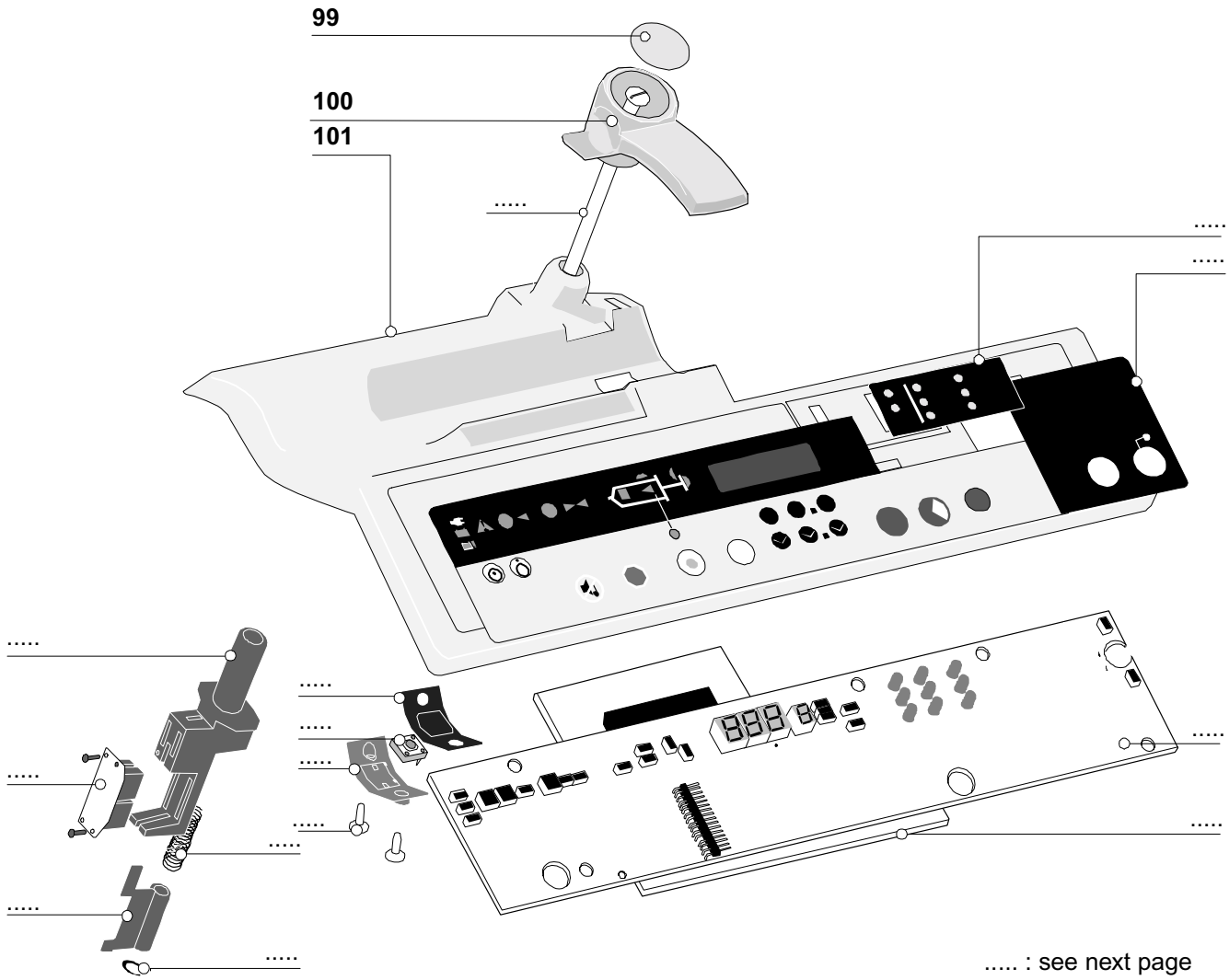
- □ H igh: Place a spacer measuring 115 mm ± 0,5 mm ref. T 300940, into the flanges groove.
  - ♦ Position the plunger in contact with the spacer.
  - ♦ Keep the plunger disengaged and press “CONFIRM”.
    The position value is read and stored in the EEPROM.
- □ Press "CONFIRM".
- □ Low: Place a spacer measuring 20 mm ± 0,5 mm ref. T 300775, into the flanges groove.
  - ♦ Position the plunger in contact with the spacer.
  - ♦ Keep the plunger disengaged and press “CONFIRM”.
    The position value is read and stored in the EEPROM.

Once both high and low values have been stored in the EEPROM, the device indicates the number of LSB in decimals between the two measurement points.
This value should be 776 ± 10 LSB.

□ If the value is out of limits, carry out the calibration procedure once again.
□ By validating once again, it is possible to select another calibration.

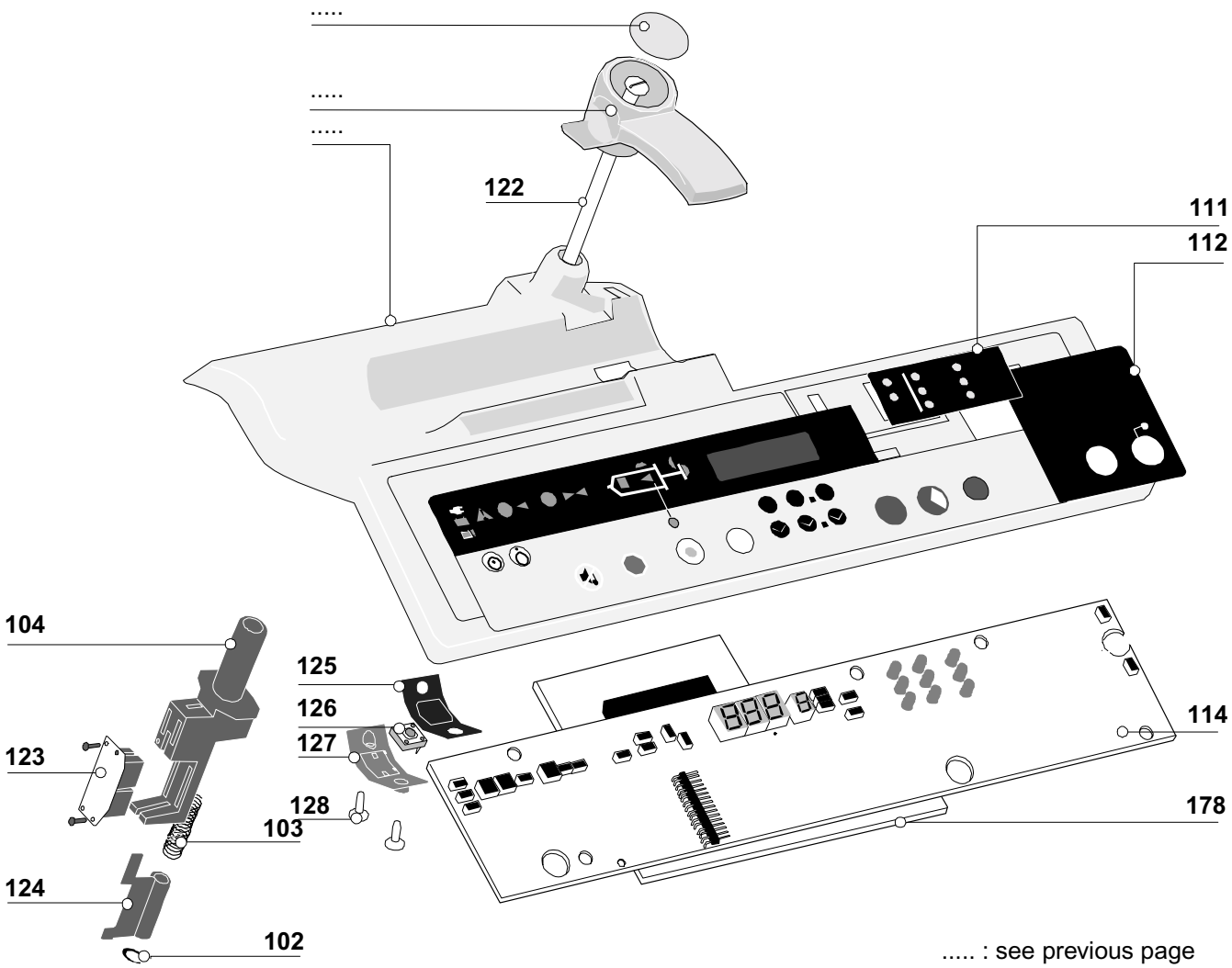
8 Spare parts catalogue

8.1 Upper case



..... : see next page

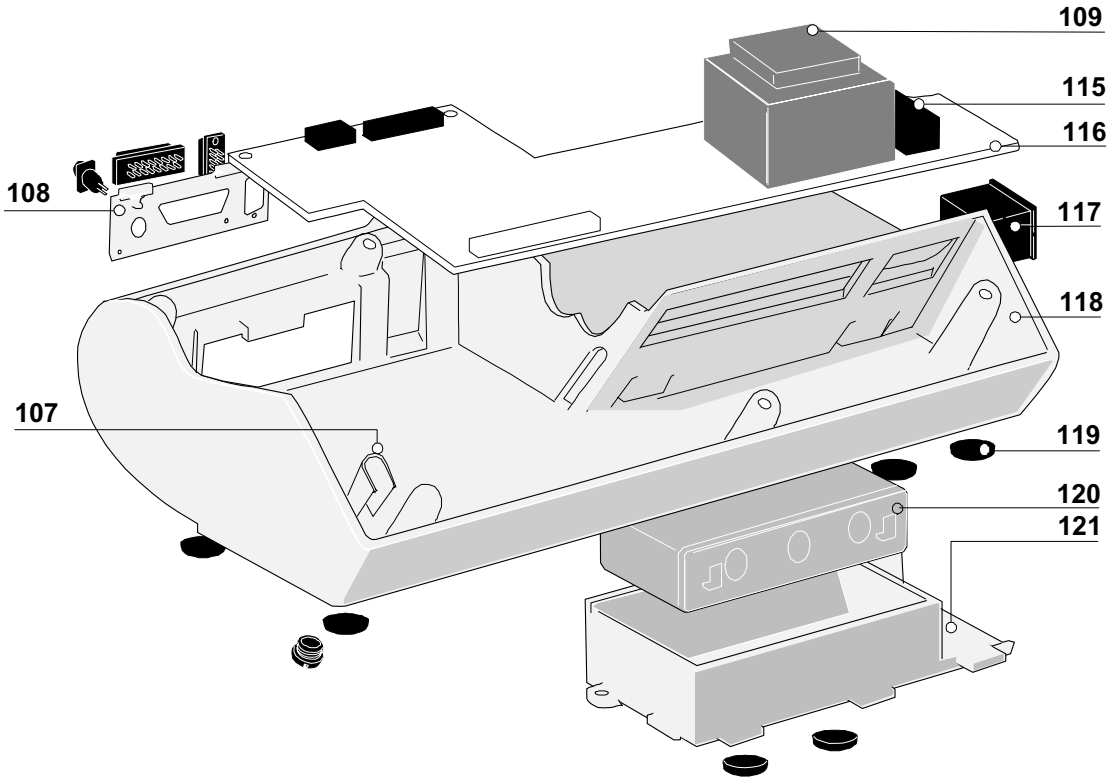
Mark	Qty	Reference	Name
99	1	167744	17.5 diam **Pilot** label
100	1	167476	20/60cc syringe clamp
101	1 1	199231 199232	Upper case + label DIN Upper case + label NL
102	1	167361	5 diam retaining ring
103	1	167310	Syringe clamp compression spring
	1	167246	LCD transparent **Pilot** window
	1	167626	6 diam injected bumper
	2	199560	Female M3x12 hybrid spacer
	1	167067	PCB 500 protective film
	1	167296	Adhesive flat jumper protective film
	1	167632	Buzzer foam
	1	167697	CPU Board Label



..... : see previous page

Mark	Qty	Reference	Name	
104	1	167452	Injected PCB support (opto)	
111	1	168140	Syringue label	
112	1 1 1	168154 168152 168153	**Pilot A2** front panel IS, SP, S, B, P **Pilot A2** front panel IT **Pilot A2** front panel NL	
114	1	167551	Display board	
	1	167704	Keyboard (active part)	
122	1	167458	Syringe clamp shaft	
123	1	167959	Wired opto PCB	
123+126 +127	1	167944	Wired CE HE 13 **Pilot** opto PCB	
124	1	167462	**Pilot** 20/60 ml obturator (not compatible with former version)	
125	1	167372	Flanges **Pilot** Switch menbrane	*Mounted on the 101 kit*
126	1	167365	ALPS SKHCAF switch	
127	1	167376	Flanges **Pilot** Switch Support	
128	2	199618	Eco-Syn TCB 2.2 x 8 screw	
178	1	167544	CPU board	

8.2 Lower case

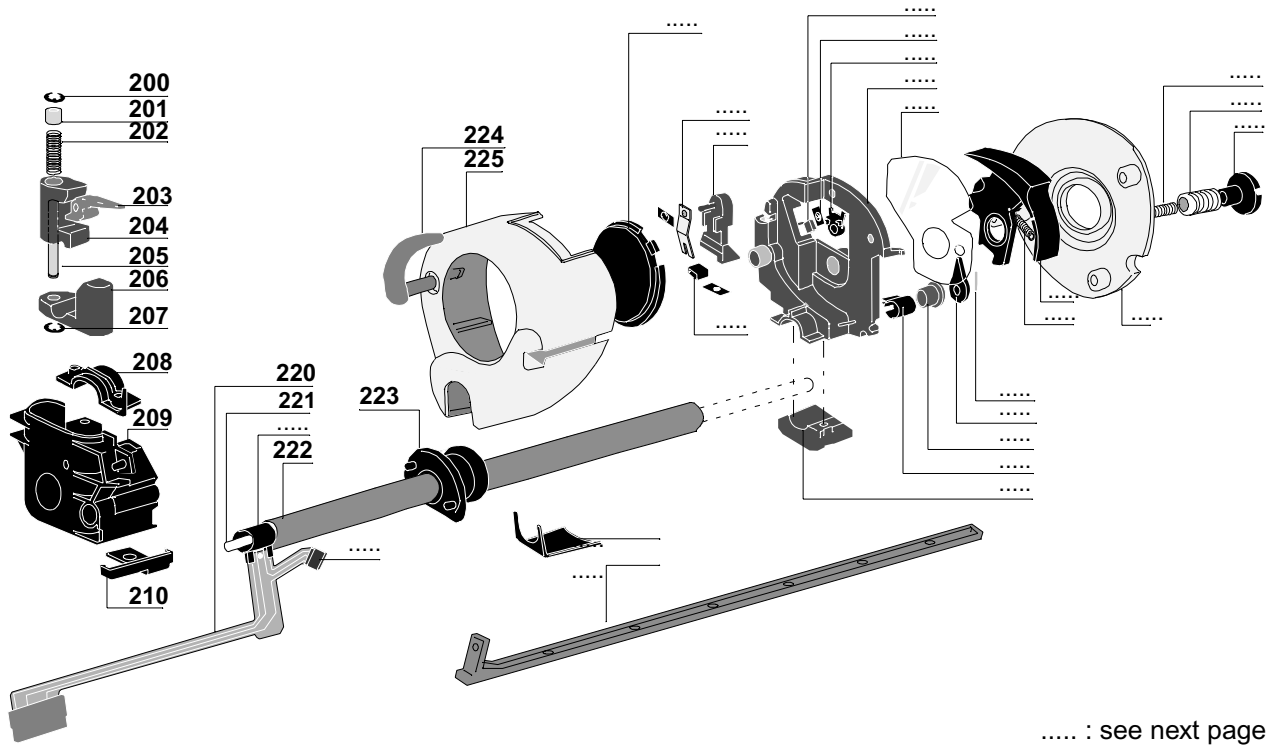


Mark	Qty	Reference	Name
107	1	167093	Buzzer bell
108	1 1	167967 167968	**Pilot A2** HE13 wired plug support **Pilot A2 RS 232** HE13 wired plug support
109	1	167113	Transformer
115	1	170228 170191	Power fuse 100 mAT Batery fuse 1.6 AT
116	1	167571 167572	**Pilot A2** HE 13 power supply board **Pilot A2 RS 232** HE 13 power supply board
117	1	166900	Wired mains socket
118	1 1 1	199201 199202 199203	Lower case + label DIN Lower case + label NL Lower case + label IS
119	6	167249	Black stop piece
120	1	174025	A500 6V 1.3Ah battery
121	1	199169	**Pilot** battery holder kit
	1	167059	**Pilot** guide rail
	1	167299	Buzzer adjustment washer
	1	167297	Spring washer
	1	165901	HE13 battery connector
	1	167122	Injected flexible PCB flange
	1	167355	Mains fibre gasket
	1	170416	Mains cord

Spare parts catalogue

Spare parts catalogue

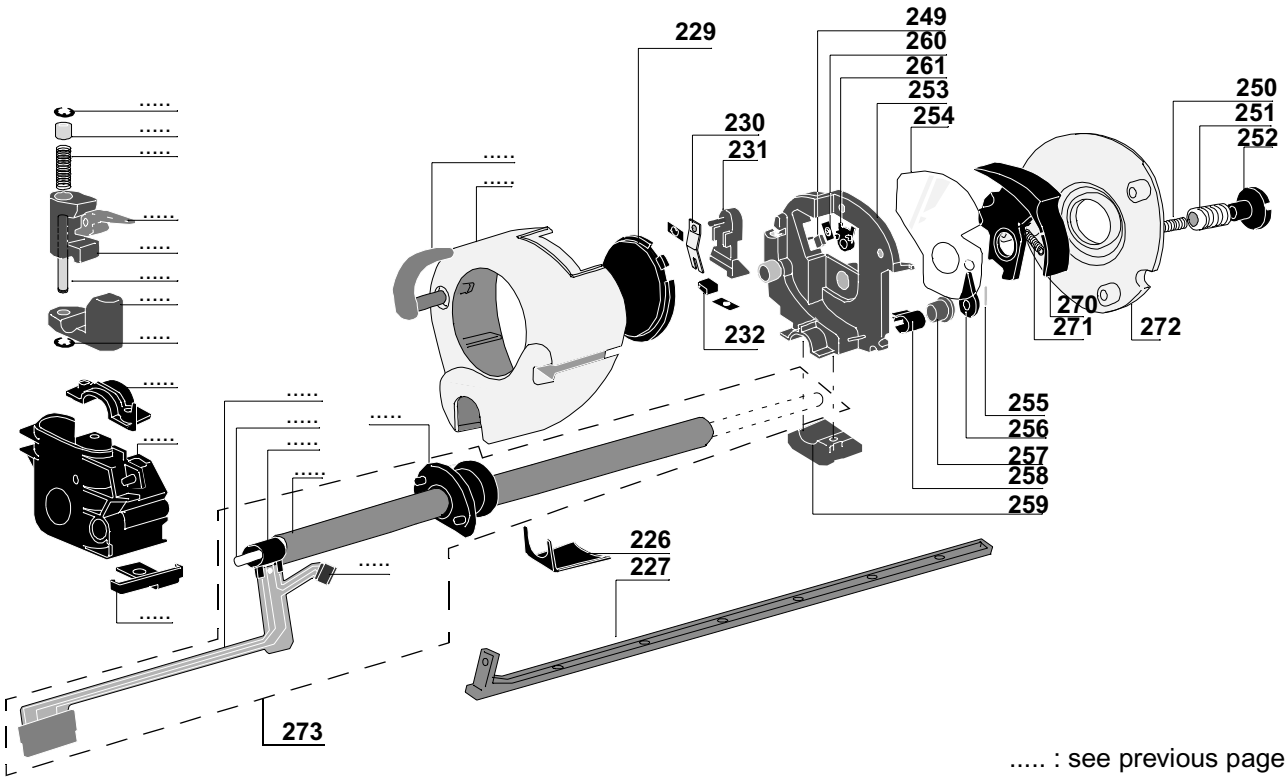
8.3 Plunger unit



..... : see next page

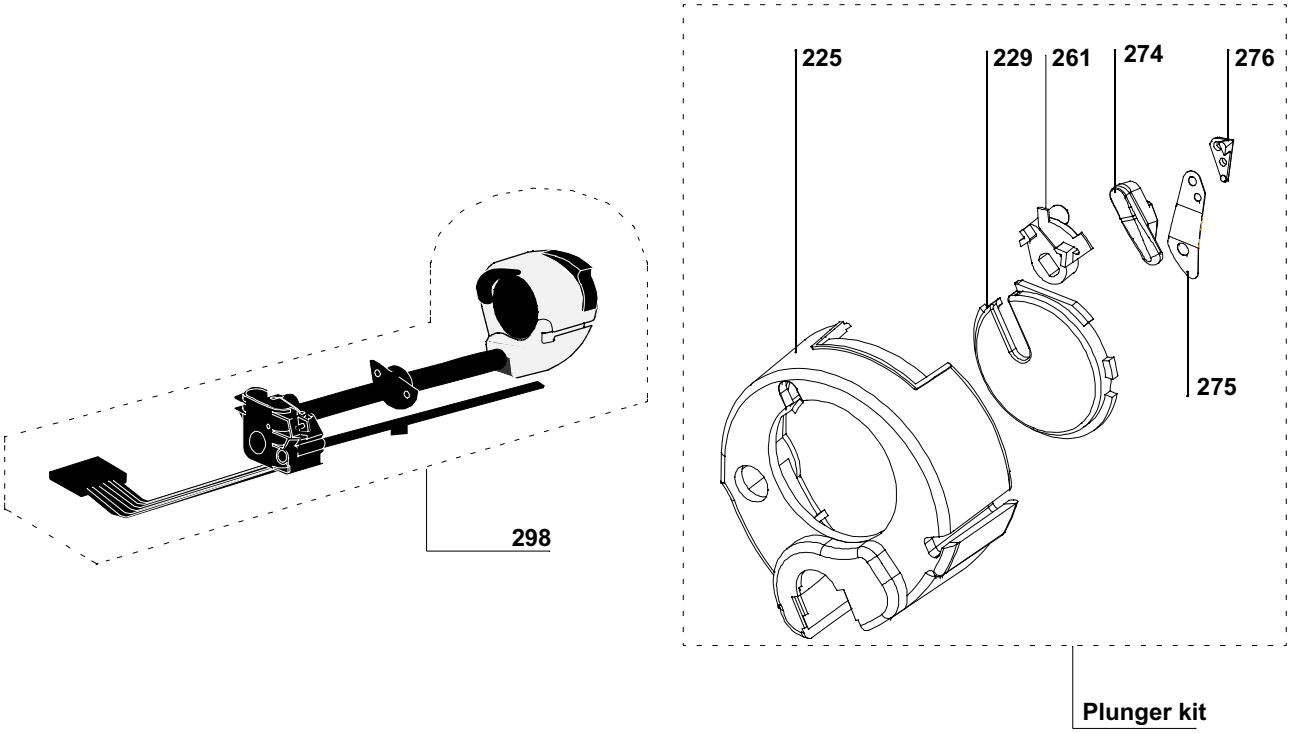
Mark	Qty	Reference	Name
200/207	2	167360	3.5mm diam retaining ring
201	1	167465	Disengagement spring follower
202	1	167469	Disengagement follower
203	1	167460	Injected disengagement cam
204	1	167471	Injected upper mechanism 1/2 nut
205	1	167464	Disengagement spring shaft
206	1	167472	Injected lower mechanism 1/2 nut
208	1	167475	Mechanical flange
209	1	167281	Mechanical block
210	1	167275	Flexible PCB clip
220	1	167271	Flex circuit
221	1	167317	Full disengagement shaft
222	1	167292	12 diam tube
223	1	167403	Slotted injected input bearing
	1	177203	O-ring (to put in the bearing)
	1	177204	Stainless steel plate (to be mounted between the bearing and the end shield)
224	1	167291	**Pilot** anti-siphon arm
225	1	167382	**Pilot** plunger cover

Spare parts catalogue



..... : see previous page

Mark	Qty	Reference	Name
226	1	167259	Plunger cover clip
227	1	167442	Injected M 0.5 rack
229	1	167383	Inj bonding pad
230	1	167411	Backpressure spring leaf
231	1	167273	Backpressure micro support (plunger)
232	1	173408	OMRON micro-switch
249	1	162311	Photo switch (type RP I 131)
250	1	167492	Backpressure spring
251	1	167270	Backpressure spring leaf adjusting screw
252	1	167269	Backpressure adjustment button
253	1	167287	Pusher holder
254	1	167497	Protective plunger film
255	1	167460	Disengagement cam
256	1	168231	Disengagement finger
257	1	167487	Sintered disengagement shaft bearing
258	2	167298	Injected flexible PCB protector
259	1	167272	Injected clamping collar
260	1	190714	Retaining ring
261	1	167385	Anti-siphon cam
	1	167264	Anti-siphon spring
270	1	167260	Disengagement lever
271	1	167245	Disengagement lever spring
272	1	167055	**Pilot A2** plunger end shield
273	1	199103	Flexible circuit + tube kit

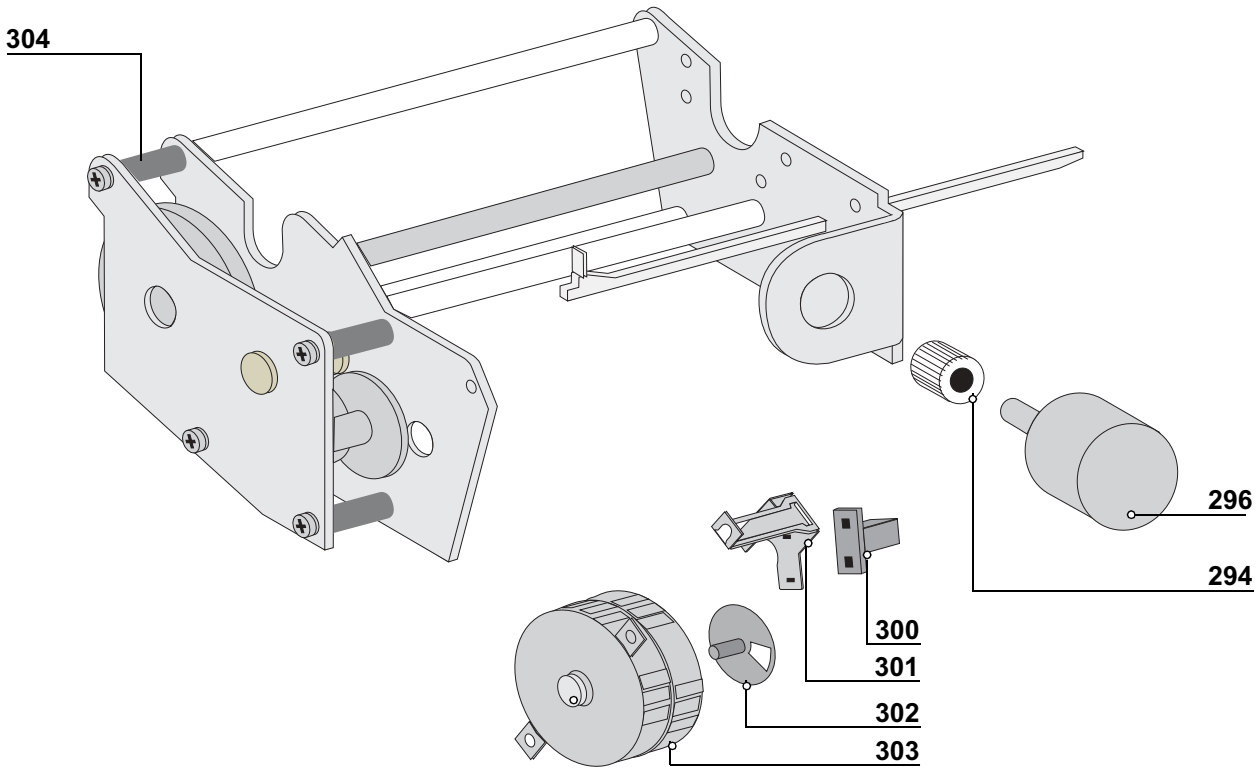


Mark	Qty	Reference	Name
225	1	199252	**Pilot** plunger cover
229			Bonding pad
261	1		Anti-siphon cam
274	1		Pil plunger removable bumper
275	1		Pil plunger spring leaf
276	1		Plate
224	1		Antisiphon arm
298	1	199135	Mechanical kit

Spare parts catalogue

Spare parts catalogue

8.4 Mechanical Gear box



Mark	Qty	Reference	Name
294	1	167443	Injected M5 pinion
296	1	167963	Position sensor
300	1	167128	Rotation photo switch
301	1	168401	Standard motor opto support
302	1	167111	Motor rotation disk
304	1	167101	Reducer frame
300/301/ 302/303	1	167533	2 ph motor + opto HE13
	2	190714	Retaining ring

Spare parts catalogue

Spare parts catalogue

8.5 Labels

Mark	Qty	Reference	Name
	1	168110	Condensed instruction guide label FR/C
	1	168164	Condensed instruction guide label IT
	1	168112	Condensed instruction guide label IS
	1	168113	Condensed instruction guide label DIN
	1	168166	Condensed instruction guide label SP
	1	168115	Condensed instruction guide label NL
	1	168163	Condensed instruction guide label S
	1	168162	Condensed instruction guide label B, P
	1	167890	Door label FR/C, DIN, IS, NL, IT, SP, S, B, P
	1	167742	Buzzer adjustement label FR/C, DIN, IS, NL, IT, SP, S, B, P
	1	167741	Danger selection label FR/C
	1	167979	Danger selection label DIN
	1	167776	Danger selection label IS
	1	167811	Dnager selection label NL
	1	167778	Danger selection label IT
	1	167858	Danger selection label SP
	1	167886	Danger selection label S
	1	167692	Danger selection label B, P
	1	168196	Battery door label FR/C, DIN, IS, S Battery door label NL, IT, SP Battery door label B, P
	1	171091	Main DANGER label (inside) Fr/C, DIN, IS, NL, IT, SP, S, B, P
	1	168197	Danger mains label (outside) FR/C, IS Danger mains label (outside) DIN Danger mains label (outside) NL Danger mains label (outside) IT Danger mains label (outside) SP Danger mains label (outside) S Danger mains label (outside) B, P
	1	NO	Diam. 36 pusher label FR/C, DIN, IS, NL, IT, SP, S, B, P
	1	168140	Syringe list label IEC/NL/IS
	1	168141	Syringe list label 10 cc IEC/IS
	1	168142	Syringe list label DIN
	1	168143	Syringe list label B
	1	168144	Syringe list label SP/P
	1	168145	Syringe list label S
	1	168146	Syringe list label IT
	1	168147	Syringe list label 10 cc IT

Spare parts catalogue

Spare parts catalogue

Useful addresses

SALES DEPARTMENT		
	Fresenius Vial Le Grand Chemin, 38590 Brézins	
	CUSTOMER SERVICE	Tel.: 00 33 (0) 4 76 67 10 81 or 00 33 (0) 4 76 67 10 54 or 00 33 (0) 4 76 67 11 08 Fax: 00 33 (0) 4 76 67 11 34
	SALES MANAGEMENT	Tel.: 00 33 (0) 4 76 67 10 81 Fax: 00 33 (0) 4 76 67 11 34
TRAINING DEPARTMENT		
	Fresenius Vial Le Grand Chemin, 38590 Brézins	Tel.: 00 33 (0)4 76 67 10 76 Tel.: 00 33 (0)4 76 67 11 40 Fax: 00 33 (0)4 76 67 11 22
AFTER SALES SERVICE		
FRANCE	After Sales Service Division GRENOBLE **Fresenius Vial** Le Grand Chemin, 38590 Brézins FRANCE	Tel.: 00 33 (0)4 76 67 10 76 Tel.: 00 33 (0)4 76 67 11 40 Fax: 00 33 (0)4 76 67 11 22
	Spare parts departement	Tel.: 00 33 (0) 4 76 67 10 34
BELGIUM	**Fresenius Vial** NV/SA Vial Médical Division Molenberglei 7 2627 Schelle BELGIUM	Tel.: 00 32 (3)8 80 73 07 Fax: 00 32 (3)8 80 50 07
GERMANY	**Fresenius MCM** AM-Neuen Berg 63749 ALZENAU GERMANY	Tel.: 49/60 23 97 22-0 Fax: 49/60 23 43 06

It is possible that this manual contains errors or typing mistakes.
Modifications may be made in the future editions.
COPYRIGHT © 2007, **Fresenius Vial S.A**.

This document may not be reproduced in part or in whole without the written permission of **Fresenius Vial S.A**.

Fresenius Vial S.A.S - siège social: Le Grand Chemin - 38590 Brézins (FRANCE)
Société par Actions Simplifiées au capital de 13 744 520 Euros
SIREN Grenoble B 408 720 282.
Design and construction: SEDOC